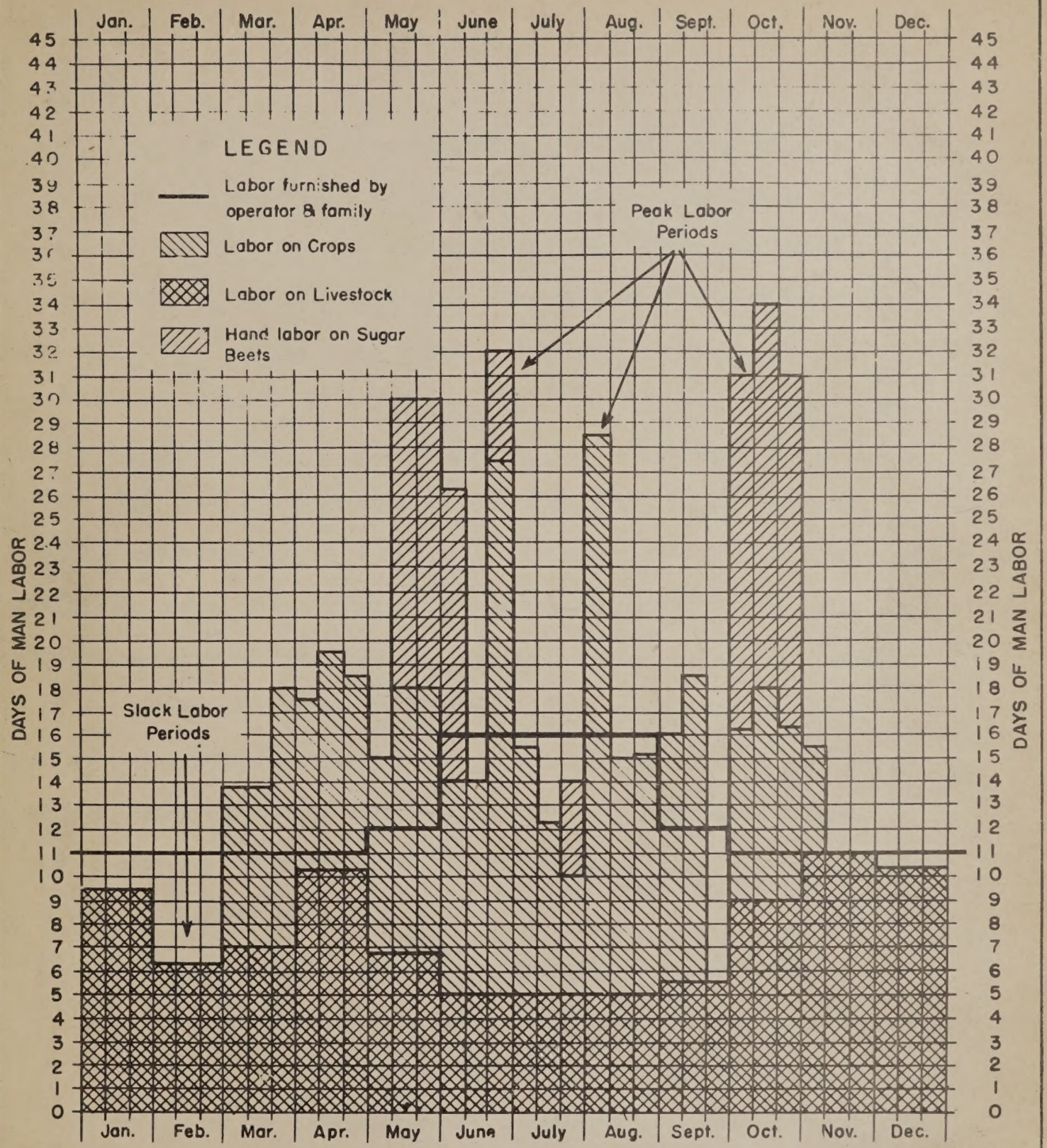
MAN LABOR REQUIREMENTS FOR IRRIGATED FARMS



MAN LABOR DISTRIBUTION ON A DIVERSIFIED IRRIGATED FARM

UNITED STATES DEPARTMENT OF AGRICULTURE

FARM SECURITY ADMINISTRATION

WATER CONSERVATION & UTILIZATION PROGRAM

DENVER, COLORADO

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FOREWORD

Someone has said, "There's no substitute for work. That applies to a nation as well as individuals." Our allies and the armed forces are using and will continue to need increasing portions of our farm produce during the coming months until Victory. Many farm workers have been called into war industries and the armed forces. This necessitates increased labor efficiency in the ranks of farm labor. It would seem the patriotic duty of every person employed in agriculture, at the National, state, county and farm level, to exert greater effort to fulfill our food needs, both at home and abroad.

It is the aim of this study to present data showing man labor requirements on irrigated farms and to describe a method whereby the labor needs of any irrigated farm can be analyzed. This report may be useful at the National, state and county level in planning for labor needs to produce the necessary food to help win the war. The individual farmers may find it useful in determining the amount of hired labor necessary and at what time it will be needed.

The author is indebted to progressive farm operators in several states for checking some of the data presented herein and to many persons connected with the U. S. Department of Agriculture, as well as research workers and others at the several western experiment stations, colleges and universities, for criticizing this report.

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MAN LABOR REQUIREMENTS FOR IRRIGATED FARMS

by

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INTRODUCTION

Farming competes with industry for at least a part of its labor. Usually the farmer must operate in such a manner that labor will return as much as or more than it costs. An exception in seasons of peak labor needs might be the hiring of extra farm labor which returns less than it costs, in order to make possible the operation of farm units large enough to adequately employ the operator and family at times that would otherwise be slack labor periods. The management and arrangement for use of labor is highly important. The organization and planning of work so it will be best adapted to the labor resources of the farm should be carefully worked out.

Since labor represents one of the largest items of cost in agricultural production, it greatly influences profits from farming. Economic investigations and cost of production studies indicate that (ignoring the general price level) labor efficiency is the most important single factor in determining the success or failure of farming operations. If sufficient enterprises are provided in a given farm plan to keep labor employed only 6 to 8 months each year, it is not reasonable to expect 12 months labor earnings for that period. Also a small farm unit that does not gainfully employ all its labor resources cannot be expected to return a satisfactory living. Unemployment or under-employment is fully as serious on our farms as in the cities.

It is realized that full, regular employment for the operator and family does not necessarily assure a profitable farm organization. Other considerations such as the general price level, rates of crop and livestock production, proper balance between crop and livestock enterprises, well adapted crop rotations, proper capitalization in machinery, livestock, etc. are important considerations in assuring a profitable farm organization.

PURPOSE OF STUDY

The primary purpose of this report is to discuss man labor requirements for livestock and irrigated crops and present a method for analyzing the monthly labor needs of a given farm unit. Since labor is such an important item of cost in the production of farm produce, it follows that in preparing farm plans for use in determining economic feasibility of the development of proposed irrigation projects, the labor requirements should be estimated with all possible accuracy.

It is not only desirable to obtain a picture of the total labor requirements, but also to show the amount of labor required by 10-day periods throughout the year for the several crop and livestock enterprises. A measure of work units has been prepared for what is termed "productive" farm work such as crop and livestock production. However, a certain amount of labor must be performed which cannot directly be assigned to any one crop or livestock enterprise. Such labor as buildings and machinery repair, fence maintenance, repair and upkeep of farm roads, bridges, etc., burning weeds and caring for work animals, is this type of labor, and the time required for this work is not included in the work unit requirements prepared for this report.

This "non-assignable" work which must be performed and the interruption of holidays, Sundays, bad weather and sickness are reasons why few operators are able to put in over 300 Productive Work Units (as measured by the work unit requirements to be presented later in this report) in one year even under a well planned farm organization. In this discussion a Productive Work Unit and a work unit are considered synonymous and either term represents the amount of "productive" work accomplished by the average or typical man in one 10-hour working day. The work unit is used to measure the amount of directly productive work required by a given farm when labor of average efficiency is employed. It is also used to measure the amount of work accomplished on the farm in a year's time. Work units are figured on the basis of the average amount of labor required to produce an acre of the various crops and the amount of time required to take care of various kinds of livestock. On an average about 105 hours of man labor is required to do all the work on an acre of sugar beets producing an average yield, thus each acre of beets represents 10.5 (Productive Work Units or) work units. About 15 days per year (150 hours) are required to care for a cow producing around 7,000 pounds of milk annually, so each dairy cow represents 15 (Productive Work Units or) work units. The time spent on all crops plus the time spent on all livestock reduced to the equivalent of days by the method explained above equals the work units on a given farm.

It is conceivable that a good manager who is also an energetic and efficient worker might do 100 percent more work per year than a shiftless, lazy operator or 40 to 50 percent more work than the average operator in the community. The Productive Work Unit "yardstick" therefore will not necessarily fit a given farm, but can be used as an average of all farms in the area.

The chart appearing on the following page shows the man labor distribution on a diversified irrigated farm. The farm organization is listed as follows:

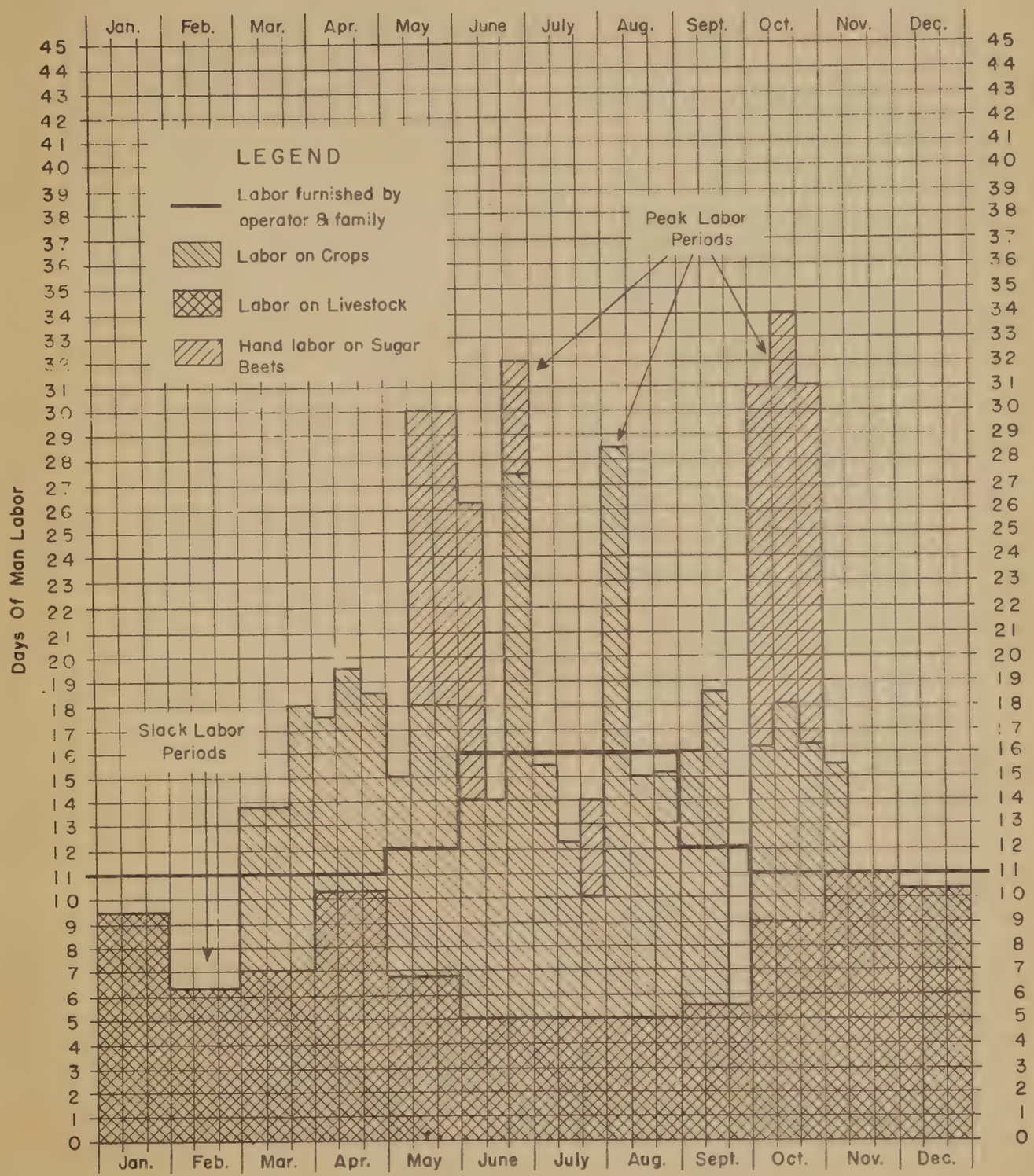
Crops	No. Acres	Per Acre Yield
Alfalfa Hay	20	3 Tons
Sugar Beets	15	13 Tons
Barley	20	45 Bu.
Field Beans	15	25 Bu.
Irrigated Pasture	20	2.0 A.U.
Other (farmstead, waste, etc.)	10	-
Total	100	

Livestock	Number	Annual Production
Dairy Cows	8	250 lbs. B.F.
Dairy Heifers	2	-
Dairy Calves Raised	2	-
Ewes and Rams	102	100 Lambs
Sows and Pigs	3 & 36	-
Chickens	100	10 doz. Eggs
Lambs Fattened	305	-
Veal Calves	5	Veal

Using the work unit requirements for crops and livestock presented in the following pages and the method for seasonal labor analysis, both of which will be discussed later, the Productive Work Units for this diversified irrigated farm were distributed throughout the year as shown in the following chart.

Form F

SEASONAL MAN LABOR DISTRIBUTION CHART



Man Labor Distribution on a Diversified Irrigated Farm

(Each Square Represents One Ten-Hour Day)

This chart shows several points of interest. First, the livestock enterprise furnishes enough labor to keep the operator and family almost fully employed throughout the winter period. There are several peak labor periods which come during haying and grain harvest and during beet thinning and topping season. Each square represents one 10-hour day of man labor. This chart shows that in addition to most of the sugar beet hand labor six or eight weeks of labor must be hired during the spring planting season and considerable labor will need to be hired during the hay and bean harvest periods.

ADAPTABILITY AND USE TO BE MADE OF THIS STUDY

The crop work unit requirements presented herein apply to general irrigated farming areas for that portion of Western United States between the 100° and 120° meridian and south to the 37° latitude. This includes the states of Montana, Wyoming, Colorado, Utah, Nevada, Idaho; the eastern parts of Washington and Oregon; the western portions of North Dakota, South Dakota, Nebraska and Kansas. The work unit requirements for livestock should be applicable throughout the United States and the method for analyzing labor needs should, with intelligent modifications by the labor analyst, also be applicable throughout the United States.

The work unit requirements (to be discussed later) are presented for use in preparing farm plans, testing or planning changes in farm work, or grouping enterprises in a farm business to make the most efficient use of farm labor. It is not assumed that they are wholly inclusive or universally applicable to each and every farm. They should be used as a guide and

whenever local practices and customs differ, should be changed to fit a given situation. It is hoped that this study presents a method which may be adapted by any analyst to fit conditions peculiar to a given locality. This discussion is not concerned with the choice or combination of enterprises, but rather with the man labor requirements for the production and harvesting of crops under irrigation. An effort has been made to present the data in a way that will be of greatest use to those dealing with farm unit planning or farm labor problems. An example of the application of this method is given, beginning on page 46.

SOURCE OF DATA

Much of the information presented herein is an abridgment of information appearing in textbooks, bulletins, mimeographed material and some unpublished data. Experiment station publications from many states have exerted an influence either directly or indirectly in the preparation of, and checking the accuracy of these data. Mimeographed material in the form of crop and livestock manuals or handbooks, releases by colleges or the extension service to county agents and planning groups, and Federal publications released for planning groups, have been useful in preparing and checking the data presented herein. Unpublished material used by several colleges in teaching farm management has been available and has proved very useful. This study has been reviewed by several economists and farm management experts and use was made of their suggestions, criticisms, and amendments. A more complete listing of books, experiment station bulletins and other published and unpublished material used in the preparation and checking of this report appears in the bibliography.

WORK UNIT REQUIREMENTS FOR LIVESTOCK

Many cost account records have been kept and many cost of production studies have been made by colleges and experiment stations throughout the United States which have furnished valuable information on average labor requirements for farm and range livestock production. The work units presented herein are based on the average number of livestock found on the average farm and as such are adaptable for planning purposes. If a given farm organization is set up to run a particularly large number of farm sheep, for example, to the exclusion of other farm livestock, the work unit of .5 per head (see next page) would probably need to be reduced since the operator of such a farm unit would likely have better labor efficiency through running a number larger than the number upon which this work unit was originally based. This also holds true with other kinds of livestock. An attempt has been made to consider this factor of greater labor efficiency through increased numbers, in preparing work unit requirements for dairy production and livestock fattening.

The following table shows work unit requirements for livestock on general farms.

Work Unit Requirements for Livestock

To determine the number of days of labor required annually by a given combination of livestock enterprises on a farm, multiply the average number of each kind of livestock by the work units assigned in the following tables and add the products. For example, 100 ewes would require 50 days (100 x .5 equals 50) and a farm flock of 50 hens would require 10 days (50 x .2 equals 10) of labor per year. One sow producing 9 pigs fattened to 200 pounds would require 7.5 work units or 3.0 for the sow and (.25 x 2 x 9 equals 4.5) 4.5 for the pigs.

Work Units Per Head	Kind of Livestock
12.0 to 18.0	Dairy type cow (see table on following page)
10.0	Dual purpose milk cow
10.0	Stallion (not worked)
6.0	Sow and litter of 6 pigs raised to 200 pounds
5.0	Mares kept only for breeding purposes
5.0	Dairy bull - confined
3.0	Dairy bull - run with cow herd
3.0	Brood sow with pigs until weaned
2.0	Colt raised on farm
1.8	Beef cows kept on the farm
1.5	Dairy heifers and calves raised
1.2	Beef cows run on range
1.0	Other beef cattle on farm including bull
1.0	Range horses
.8	Young cattle run on range
.5	Breeding ewes and rams - run on farm, covers work on lambs but not shearing
.5	Boar
.5	Stallion fees, each
.4	Range sheep
.4	Calves raised for veal
.4	Turkey hens or toms or geese
.3	Turkey poults raised
.25	Pigs fattened (for each 100 pounds of pork produced)
.20	Chicken hens or ducks (small farm flock)
.10	Pullets raised (small farm flock)
.10	Lambs creep fed

Work Unit Requirements for Dairy Cows

The amount of labor required in dairying is influenced by the type of production (butterfat or whole milk) as well as by the annual production per cow in butterfat or whole milk and by the number of cows in the herd.

General studies are available on the labor requirements for dairying under different types of production, but little has been published regarding the influence of either the size of herd or annual production per cow on labor requirements. These factors were considered in computing the work units discussed below.

This table is based on a feeding period of 7 to 8 months with pasture during the remaining time. If the feeding period is considerably different from this, these figures should be adjusted to correct for the difference in the amount of labor used in feeding and in cleaning barns when the feeding period is lengthened or shortened.

Annual Milk Production in Pounds	Pounds of Butterfat Per Cow with Various Butterfat Tests					Number of Cows in Herd					
	3	3½	4	4½	5	4	8	12	16	20	24
						Work Units per Cow per Year					
5,000	150	175	200	225	250	15.3	14.5	13.8	13.2	12.7	12.3
5,750	172	201	230	259	288	15.7	14.9	14.2	13.6	13.1	12.7
6,500	195	228	260	292	325	16.1	15.3	14.6	14.0	13.5	13.1
7,250	218	254	290	326	362	16.5	15.7	15.0	14.4	13.9	13.5
8,000	240	280	320	360	400	16.9	16.1	15.4	14.8	14.3	13.9
8,750	262	306	350	394	438	17.3	16.5	15.8	15.2	14.7	14.3

An explanation of how to read this table follows: Assume one wishes to know the labor requirement for a herd of 12 Holstein cows with an average annual production of 240 pounds of butterfat (3% test) per cow. A glance at the table under "3% butterfat" column shows 240 pounds of butterfat, and reading that line to the right under the column "12 cows per herd" shows a work unit of 15.4 days per cow per year. If production is given in pounds of milk, that portion of the table dealing with pounds of butterfat can be ignored. If the milk is to be delivered to customers, the man labor requirement would need to be adjusted to consider the increase in labor needed for milk delivery. Data not presented in the table can be approximated by interpolation.

Work Unit Requirements for Fattening Livestock*

Presented below is a table showing the work unit requirements per head for fattening calves, yearling steers, 2-year old steers and lambs. About 100 days are required to fatten lambs, with 133 days for 2-year old steers, 166 days for 1-year old steers and 200 days for calves. The work unit requirement (.85 and .085 at top of table) was determined by dividing the number of days each class of livestock is fed by the number of livestock of each class that one man can care for when working full time. At the foot of the table the work units (1.60 and .160) are slightly greater than the labor requirement per head for wintering a small number of livestock on the farm (see page 9). When the feeder is working at less than his full capacity, poorer labor efficiency is involved as is attested by the table. Assume the feeder is fattening only 170 calves, the work unit per head would be 1.00 compared with .85 when feeding 235 or if he were feeding only 360 lambs, the work unit per lamb would be .130 compared with .085 if he were operating at full capacity (1,200 head).

Beef Cattle Fattening

Work Unit Per Head	Number of Head Fattened			Work Unit Per Head	No. Head
	Calves	1 yr. Steer	2 yr. Steer		
.85	235	195	156	.085	1,200
1.00	170	140	110	.100	870
1.15	115	95	75	.115	590
1.30	70	60	45	.130	360
1.45	35	30	22	.145	180
1.60	10	8	6	.160	55

*The ability to make money at fattening is more dependent on the operator's ability or knowledge of feeding (the "know how" of feeding) than it is upon labor efficiency. Labor efficiency in feeding is influenced more by the arrangements of corrals, feed, water, and other feeding facilities than by any other single factor. In other words, the amount of capital invested in feeding facilities is important. Also properly equipped, experienced feeders will handle considerably more livestock than has been set up as a full unit for the average feeder. The figures presented above should be satisfactory for the average feeder operating with typical feeding facilities.

WORK UNIT REQUIREMENTS FOR IRRIGATED CROPS

The work units prepared for field crops are based on an irrigated farm of average size powered by a small one-bottom tractor and with horses for some operations. The work units should be reduced if the farming is on a large scale with large tractors and equipment. Also a manager who is above average in labor efficiency would probably care for a crop with a large yield as easily as the poorer manager would care for a crop with a lower yield. However, the difference in work unit requirements between low yields and high yields is not due alone to the additional labor involved in harvesting, but also to the additional time spent in cultivating and irrigating and preparing the seed bed.

Soil texture has considerable influence on total labor requirements as well as on the labor requirements for cultural operations. These requirements, however, tend to counterbalance each other. For example, a light sandy soil requires considerably more time for irrigating than a heavier soil, but this disadvantage is offset by greater ease in preparing the seed bed and cultivating.

The tables on the following pages show the labor requirements for crops with high, medium and low per acre yields. Numerous other factors besides yield, such as soil texture and size and shape of field, influence labor requirements; however, it is impracticable to attempt to show these statistically. As a general rule, whenever the size of a plat is less than 5 acres, 10 percent increase in the labor requirement per acre is necessary and whenever the plat is over 10 acres in size, 5 percent less labor is needed. The two pages which follow present data on total work unit requirements for irrigated crops.

Total Per Acre Work Unit Requirements for Crops

To determine the number of days of labor required by a given combination of crops, multiply the number of acres of each crop by the appropriate work unit supplied by the following tables and add the products.

Hay - Harvested by Wagons or Stacker

Work Unit		
2.10	Low Yield	2 Tons per Acre (wagons)
1.80	" "	2 " " " (stacker)
2.60	Medium Yield	3 " " " (wagons)
2.20	" "	3 " " " (stacker)
3.10	High Yield	4 " " " (wagons)
2.60	" "	4 " " " (stacker)

Small Grains - Threshed or Combined

Threshed from Shock	Combined		
Work Unit			
1.80	1.40	Low Yields -	Wheat under 20 Bu.
			Barley " 25 "
			Oats " 30 "
2.10	1.60	Medium Yields -	Wheat ave. 35 "
			Barley " 45 "
			Oats " 55 "
2.40	1.80	High Yields -	Wheat over 50 "
			Barley " 65 "
			Oats " 80 "

Field Beans and Snap Beans

(does not include labor for hand picking snap beans)

Work Unit		Field Beans	Snap Beans
3.50	Low Yield	under 15 Bu.	under 2 Tons
4.00	Medium Yield	ave. 25 "	ave. $3\frac{1}{2}$ "
4.50	High Yield	over 35 "	over 5 "

Sugar Beet Production - Including Hand Labor

9.0	Low Yield	under	10 Tons
10.5	Medium Yield	ave.	13 "
12.0	High Yield	over	16 "

Total per Acre Work Unit Requirements for Crops

Sugar Beet Production - Excluding Hand Work

Work Unit			
4.00	Low Yield	under	10 Tons
4.50	Medium Yield	ave.	13 "
5.00	High Yield	over	16 "

Irrigated Potatoes - Table Stock (includes sorting and grading)

6.00	Low Yield	under	167 Bu.	100 sacks
7.50	Medium Yield	ave.	250 "	150 "
9.00	High Yield	over	333 "	200 "

Irrigated Potatoes - Certified Seed (Includes all work)

7.50	Low Yield	under	167 Bu.	100 sacks
9.00	Medium Yield	ave.	250 "	150 "
10.50	High Yield	over	333 "	200 "

Corn - Husked from shock or sweet corn for canning factory

4.00	Low Yield	under	25 Bu.	under 3 Tons
4.50	Medium Yield	ave.	40 "	ave. 4½ "
5.00	High Yield	over	55 "	over 6 "

Corn - Husked from field

3.00	Low Yield	under	25 Bu.
3.50	Medium Yield	ave.	40 "
4.00	High Yield	over	55 "

Corn for Silage with Corn Harvester

4.5	Low Yield	under	6 Tons
5.0	Medium Yield	ave.	10 "
5.5	High Yield	over	14 "

Shelled Peas for Canning

2.30	Low Yield	under	1.00 Tons
2.65	Medium Yield	ave.	1.75 "
3.00	High Yield	over	2.50 "

.40	Irrigated permanent pasture
.80	Irrigated rotation pasture

Work Unit Requirements Per Acre for Crops by Cultural Operations

The work unit requirements for crop production under irrigation have been prepared by cultural operations. These cultural operations have been segregated into 5 steps for cultivated crops, namely: 1. Preparation of Land. 2. Planting. 3. Cultivating. 4. Irrigating. 5. Harvesting. It is desirable to have the foregoing work units for crop production segregated by cultural operations so as to enable the analyst to distribute the labor throughout the year as shown in the labor distribution chart for a diversified irrigated farm. Certain related work such as cutting potato seed is included under planting; the work of spraying, roguing, etc. is included under cultivating. The harvesting of certified seed potatoes includes sorting, grading and hauling to market. Other related operations for field crop production, while not mentioned specifically, are included under the appropriate cultural operation. For the information needed to segregate the work units into types of operations as described above, cost-of-production studies by colleges and experiment stations were available as well as some unpublished results of research into the influence of yield on labor requirements.

While it is recognized that numerous factors influence the amount of farm labor required for the various cultural operations, it is impracticable to consider statistically all of these variations in preparing work unit standards, and it is believed that those presented herein are satisfactory for their intended use.

The two pages which follow present the same work unit requirements that are given in the two preceding pages, but they have been segregated by cultural operations.

Work Unit Requirements per Acre for Crops by Cultural Operations

The data on this and the following page present work unit requirements per acre by cultural operations for various irrigated crops with low, medium and high yields.

Alfalfa Hay	Harvested with Stackers			Wagons		
	Low	Medium	High	Low	Medium	High
Cultivating	.10	.15	.20	.10	.15	.20
Irrigating	.60	.65	.70	.60	.65	.70
Harvesting	1.10	1.40	1.70	1.40	1.80	2.20
Total	1.80	2.20	2.60	2.10	2.60	3.10

Sugar Beets	Low	Medium	High
Prep. of land, etc.	1.05	1.20	1.35
Planting, etc.	.25	.25	.25
Cultivating, etc.	.60	.70	.80
Irrigating	.85	.90	.95
Harvesting	1.25	1.45	1.65
Sub-total	4.00	4.50	5.00
Thinning	2.30	2.45	2.60
Hoeing	.50	.60	.70
Topping	2.20	2.95	3.70
Total	9.00	10.50	12.00

Potato Production (Table Stock)	Low	Medium	High
Prep. of Land, etc.	.90	1.00	1.10
Planting and cutting seed, etc.	1.05	1.15	1.25
Cultivating-Spraying-etc.	1.00	1.20	1.40
Irrigating	.60	.65	.70
Harvesting and marketing	2.45	3.50	4.55
Total	6.00	7.50	9.00

Potato Production (Certified Seed)	Low	Medium	High
Prep. of Land, etc.	.90	1.00	1.10
Planting, cutting and treating seed	1.15	1.25	1.35
Cultivating and roguing, spraying	1.65	1.80	1.95
Irrigating	.60	.65	.70
Harvesting, sorting, grading, marketing	3.20	4.30	5.40
Total	7.50	9.00	10.50

Rotation Pasture

Cultivating	.15	Irrigating	.65	Total Work Units	.80

Work Unit Requirements Per Acre for Crops by Cultural Operations

Bean Production (Field or Snap)	Low	Medium	High
Preparation of Land, etc.	.90	1.00	1.10
Planting, etc.	.25	.25	.25
Cultivating and hoeing	1.00	1.10	1.20
Irrigating	.60	.65	.70
Harvesting	.75	1.00	1.25
Total	3.50	4.00	4.50

Shelled Peas for Canning	Low	Medium	High
Preparation of Land, etc.	.90	1.00	1.10
Planting, etc.	.20	.20	.20
Irrigating	.50	.55	.60
Harvesting	.70	.90	1.10
Total	2.30	2.65	3.00

Corn Production	Husked from Field			Husked from Shock		
	Low	Medium	High	Low	Medium	High
Prep. of Land, etc.	.70	.75	.80	.70	.75	.80
Planting, etc.	.20	.20	.20	.20	.20	.20
Cultivating	.60	.65	.70	.60	.65	.70
Irrigating	.50	.55	.60	.50	.55	.60
Harvesting	1.00	1.35	1.70	2.00	2.35	2.70
Total	3.00	3.50	4.00	4.00	4.50	5.00

Silage Corn Production	With Corn Harvester		
	Low	Medium	High
Preparation of Land, etc.	.70	.75	.80
Planting, etc.	.20	.20	.20
Cultivating	.60	.65	.70
Irrigating	.50	.55	.60
Harvesting and Ensiling	2.50	2.85	3.20
Total	4.50	5.00	5.50

Small Grain Production	Threshed from Shock			Combined		
	Low	Medium	High	Low	Medium	High
Preparation of Land	.60	.65	.70	.60	.65	.70
Planting, etc.	.20	.20	.20	.20	.20	.20
Irrigating	.50	.55	.60	.50	.55	.60
Harvesting	.50	.70	.90	.10	.20	.30
Total	1.80	2.10	2.40	1.40	1.60	1.80

LABOR UNITS FURNISHED ANNUALLY BY FARM OPERATOR AND FAMILY

The farms planned for irrigation should be of sufficient size to use the full time of the operator and his family. Operation of the farming enterprise on an intensive scale is usually an attempt on the part of the operator and family to market their labor and management through farm produce at a higher price than might be obtained in some other type of employment. For this reason during peak labor seasons labor will need to be hired if the unit is to be large enough to keep the operator and his family employed during the remainder of the year.

For such crops as sugar beets, commercial garden truck and certain canning-factory crops which require a large amount of hand labor at times when other farm work is near its peak, it is anticipated that hired labor will be necessary. However, it requires better than average management to make large gains from hiring labor, and not all farm operators have this ability. Unless an operator has greater than average management ability, he should not grow such crops or follow a farming program which will require a great deal of hired labor. In general, only as much intensive crops should be grown by the operator who is sub-average in managerial ability as can be cared for by himself and the family.

One purpose of the farm plan is to so organize livestock and cropping programs that the operator and his family are fully and evenly employed throughout the year.

The following table shows the estimated days of labor which the operator and his family can furnish annually under different combinations of crop and livestock enterprises.

Days of Labor (Work Units) Furnished Annualy by Farm Operator and Family Under Different Types of Farming

No.	Type of Farming and Kind of Livestock	Days of labor (work units) Furnished Annually by: Operator	Family*	Total
1.	Crop production and full dairy unit.**	300	150	450
2.	Crop production and 1/2 dairy unit and 1/2 livestock fattening unit.	300	150	450
3.	Crop production and winter fattening of Livestock.***	285	120	405
4.	Crop production and farm flock of sheep or beef herd kept on farm.	250	120	370
5.	Crop production - no dairy or fattening or wintering of livestock.	180	80	260

*The family labor is assumed to be equal to one-half of the operator's labor on a full dairy unit and correspondingly less on other units which do not permit daily use of the family's labor before or after school hours. Where the family labor resources of a given farm are known, some revision of the above contributions of family labor may be desirable.

**A full dairy unit would consist of 20 cows.

***A full livestock fattening unit would consist of the number of the various kinds of livestock shown in the top line in the table on page 11.

Explanation of Table:

A farm with a full dairy unit combined with crop production (type of farming No. 1) or a farm with crop production and 1/2 of a dairy unit and 1/2 of a winter fattening unit (type of farming No. 2), permit greater labor efficiency than any other type of farming shown in the table above.

To show how the foregoing table might be used, assume the following full dairy farm organization:

Livestock	Number	Work Unit Per Head	Total Work Units
Dairy Cows	20	15.0	300.0
Dairy Heifers	8	1.5	12.0
Veal Calves	15	.4	6.0
Other Calves	5	1.5	7.5
Sows	5	3.0	15.0
Pigs	30	.5	15.0
		Total	355.5

Crops	Acres	Work Unit per Acre	Total Work Units
Hay	40	2.6	104.0
Sugar Beets	15	12.0	180.0
Grain	40	2.1	84.0
		Work Units - Crops	368.0
		" " Livestock	355.5
		Total Work Units - Farm	723.5

These calculations indicate that to operate this theoretical farm unit a total of 723.5 Productive Work Units or days of labor are required. The operator and family should be able to furnish 450 (see table on preceding page) of the total leaving (723.5 minus 450.0 equals 273.5) 273.5 days to be hired. On a farm producing only crops with no livestock, the operator can furnish only 180 days and the family only 80 days of the total requirement (see type of farming No. 5 on preceding page).

The table (page 19) shows that winter fattening of livestock combined with crop production, also offers excellent labor efficiency for the operator, but is not conducive to the best labor efficiency by the unpaid family labor of school age. The children can contribute less labor on a livestock fattening farm than on a dairy farm, as most of the feeding is usually done during school hours. On such a farm the unpaid family labor can do much of the work on dairy, poultry, swine, etc. but little of the livestock feeding.

Where wintering of livestock (type of farming No. 4, page 19) is substituted for livestock fattening as the source of winter employment, the unpaid family labor can be used about the same as with a fattening unit, but in neither case is it used to its greatest efficiency as shown by dairying. Considerably less labor is generally involved in wintering livestock than in fattening livestock, therefore the amount of work provided for the operator is less and thus he has slack employment periods throughout the winter. If sufficient livestock were available to be wintered, the operator could keep as busy on such a unit as with fattening, but a full fattening unit usually requires more labor than wintering the livestock commonly found on an irrigated farm.

Where no livestock are kept (type of farming No. 5) except possibly a family cow and a few chickens (a condition not recommended, but often encountered among inefficient farm managers), there is little productive winter employment and labor distribution is very poor. On such a farm, little work is provided for the family except during the cropping season. On a dairy setup the school children are able to contribute much of their help year around.

It would be desirable to have data showing the amount of labor which might be contributed annually by the farm operator and family for different areas representing different lengths of growing season. To a large extent the number of days climatically favorable for work is not greatly different in many widely separated agricultural areas. The long southern growing seasons permit winter cropping which often replaces the livestock fattening or dairying which furnish much winter employment for northern farmers.

The table on the following page is a breakdown of the table on page 19 discussed above. It shows the distribution of the labor of the operator and family by months for several types of farming. With a full dairy unit and crop production, the operator is able to contribute 25 days per month year around. With other types of farming the operator can keep himself fully employed during the cropping season, but during the winter, insufficient labor is provided to keep him employed full time. The family can contribute more labor in a year on a dairy farm than on any other farm. They can also contribute considerably more in the late spring, summer and early fall when school is out and the days are longer, than during the school season.

Like some other data presented herein, these are subject to correction and amendment as further studies reveal more accurate information.

DAYS OF LABOR (WORK UNITS) FURNISHED MONTHLY BY THE FARM OPERATOR AND FAMILY UNDER DIFFERENT TYPES OF FARMING

Crop Production and Full Dairy Unit or 1/2 Dairy Unit and 1/2 Fattening Unit					Crop Production and Winter Fattening of Livestock			
Month	Operator	Family	Total	1/3 Tot.*	Operator	Family	Total	1/3 Tot*
Jan.	25.0	8.0	33.0	11.0	22.5	5.0	27.5	9.2
Feb.	25.0	8.0	33.0	11.0	22.5	5.0	27.5	9.2
Mar.	25.0	8.0	33.0	11.0	22.5	5.0	27.5	9.2
April	25.0	8.0	33.0	11.0	25.0	5.0	30.0	10.0
May	25.0	11.0	36.0	12.0	25.0	10.0	35.0	11.7
June	25.0	24.0	49.0	16.3	25.0	22.0	47.0	15.6
July	25.0	24.0	49.0	16.4	25.0	22.0	47.0	15.6
Aug.	25.0	24.0	49.0	16.3	25.0	22.0	47.0	15.6
Sept.	25.0	11.0	36.0	12.0	25.0	9.0	34.0	11.3
Oct.	25.0	8.0	33.0	11.0	22.5	5.0	27.5	9.2
Nov.	25.0	8.0	33.0	11.0	22.5	5.0	27.5	9.2
Dec.	25.0	8.0	33.0	11.0	22.5	5.0	27.5	9.2
Total	300.0	150.0	450.0	150.0	285.0	120.0	405.0	135.0

Crop Production and Farm Flock of Sheep or Beef Herd Kept on Farm					Crop Production: No Dairying or Fattening or Wintering of Livestock			
Month	Operator	Family	Total	1/3 Tot.*	Operator	Family	Total	1/3 Tot.*
Jan.	16.0	5.0	21.0	7.0	5.0	1.0	6.0	2.0
Feb.	16.0	5.0	21.0	7.0	5.0	1.0	6.0	2.0
Mar.	18.0	5.0	23.0	7.8	5.0	1.0	6.0	2.0
April	25.0	5.0	30.0	10.0	25.0	1.0	26.0	8.7
May	25.0	10.0	35.0	11.6	25.0	6.0	31.0	10.3
June	25.0	22.0	47.0	15.6	25.0	20.0	45.0	15.0
July	25.0	22.0	47.0	15.6	25.0	20.0	45.0	15.0
Aug.	25.0	22.0	47.0	15.6	25.0	20.0	45.0	15.0
Sept.	25.0	9.0	34.0	11.3	25.0	7.0	32.0	10.7
Oct.	18.0	5.0	23.0	7.8	5.0	1.0	6.0	2.0
Nov.	16.0	5.0	21.0	7.0	5.0	1.0	6.0	2.0
Dec.	16.0	5.0	21.0	7.0	5.0	1.0	6.0	2.0
Total	250.0	120.0	370.0	123.3	180.0	80.0	260.0	86.7

Explanation: The data in these tables can be used as a guide in estimating the amount of labor which can be furnished by the operator and family by months on a farm with a particular type of farming. On a full dairy unit the typical operator will average 300 10-hour days (300 P.W.U.'s) per year and the family will average one-half of this amount.

*The data in the total column was divided by 3 to permit the data to be presented in chart form by 10-day intervals (see curve in graph on Page 5 and Page 44).

LENGTH OF GROWING SEASON

Length of growing season greatly affects distribution of farm labor because of limitations on the kind of crops which can be grown. A growing season of less than 90 days precludes the growing of most agricultural crops except hay and some grains. Many high mountain valleys of the West have growing seasons of 50-60 days which limit crop production to native hay. In such areas light frosts may occur any month in the year and only hardy grasses can withstand them. In areas of less than 80 days growing season, grain production is hazardous. When caught by a midsummer frost the grain is usually harvested as forage unless it is nearing the hard dough stage, when it may be harvested as damaged grain with correspondingly lower feeding value.

Length of growing season also influences the time for planting, harvesting and irrigating. Short growing seasons necessitate timeliness in operations and limit the amount of acreage which can be handled by one man due to the shortness of time available in which to do the work.

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

The eight charts (Form B) which follow show the optimum dates for performance of cultural operations in the following areas:

Area Upon Which Data are Based	Length of Growing Season in Days	Dates of Growing Season
Hutchinson, Kansas	185	4/18 - 10/20
Garden City, Kansas	175	4/23 - 10/15
Arkansas Valley in Colorado	165	4/28 - 10/10
Ft. Collins - Greeley, Colo.	145	5/8 - 9/30
Torrington - Basin, Wyo.	135	5/13 - 9/25
Lovell - Cody, Wyo.	125	5/18 - 9/20
San Luis Valley, Colo.	115	5/30 - 9/22
Bridger Valley, Wyo.	95	6/9 - 9/12

It should be kept in mind that these charts merely show when the various cultural operations should be performed and not the amount of labor required. For example, the following page shows that to obtain optimum results in the Hutchinson, Kansas area, oats and barley should be planted from the 1st to the 20th of March, etc.

These eight charts have been checked in the field by local agricultural authorities including county agents, project supervisors and several progressive farmers. The information on dates of planting and harvesting was secured from State Colleges and Experiment Stations in many of the seventeen western states. The chart was first prepared in the office based on the dates suggested by the institutions mentioned above and then each chart was either taken or [illegible] to the field for review by agriculturalists listed above. They were later revised to consider criticisms from the field.

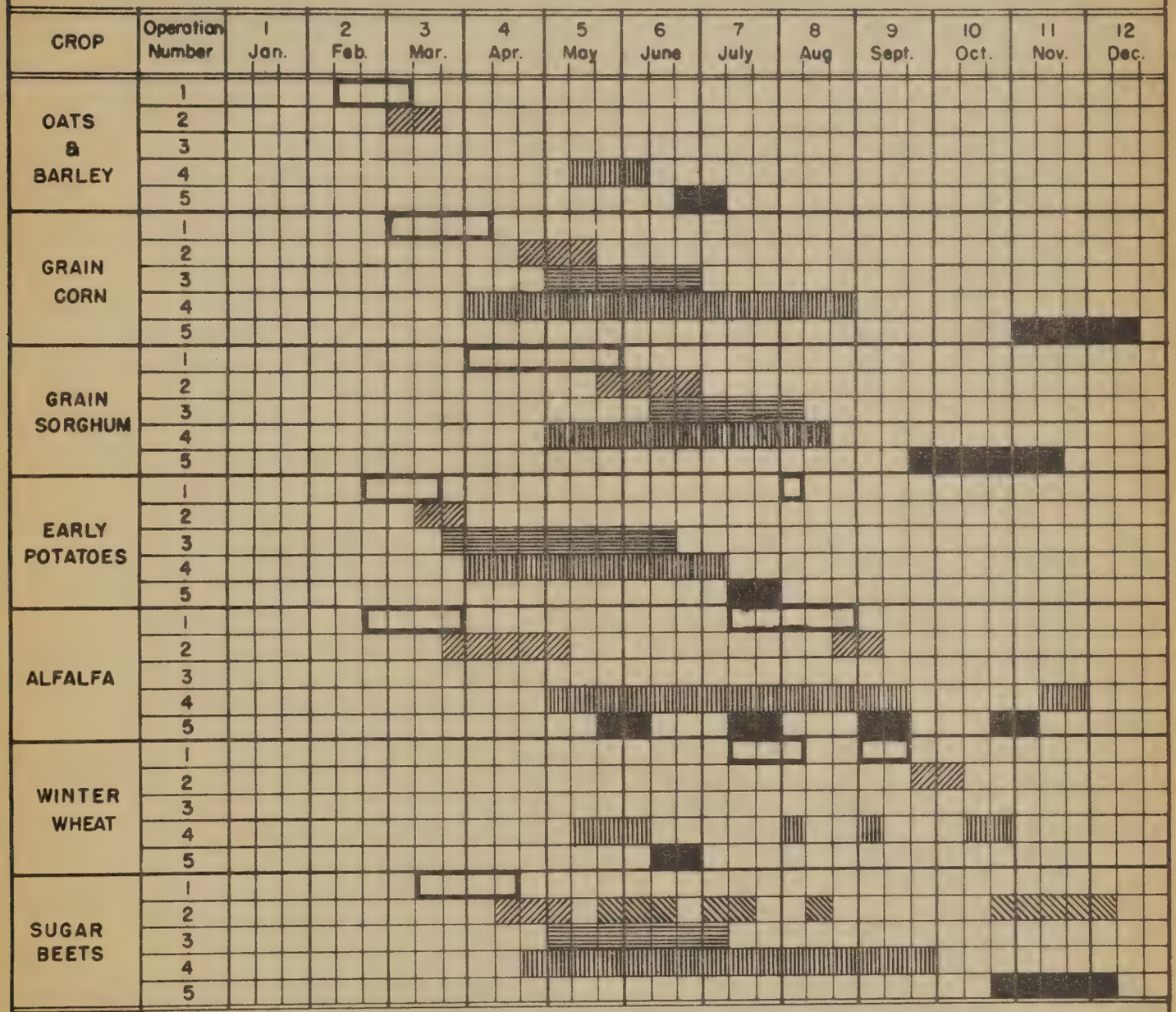
It should be noted that these dates for cultural practices may not necessarily fit a given locality for all years due to the variation in growing season; however, for planning purposes they are satisfactory. The labor analyst should prepare a similar chart for each area in study. The peculiarities of the area, etc. could then be considered and more accuracy could be obtained.

To conserve space in the following charts, the cultural operations are referred to by number rather than by name. (See key on charts).

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area HUTCHINSON, KANSAS Growing Season APR. 18 TO OCT. 20 185 days.

Annual Precipitation 27.6 inches. Growing Season Precipitation 19.3 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting &

Hand Labor on Sugar Beets

Operation No. 3. Cultivating

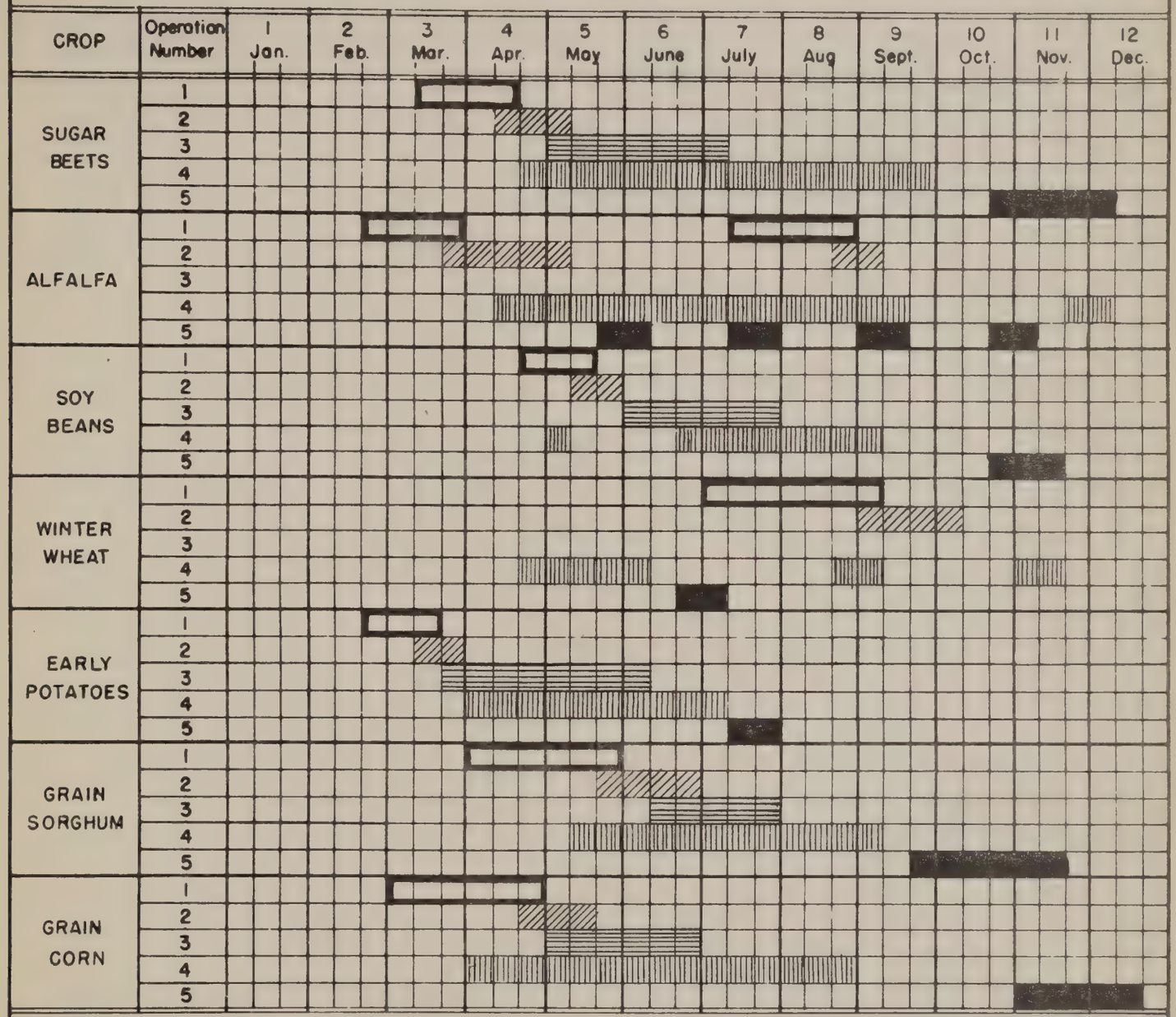
Operation No. 4. Irrigating

Operation No. 5. Harvesting

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area GARDEN CITY, KANSAS Growing Season APR. 23 TO OCT. 15 175 days.

Annual Precipitation 17.51 inches. Growing Season Precipitation 13.34 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

Operation No. 4. Irrigating

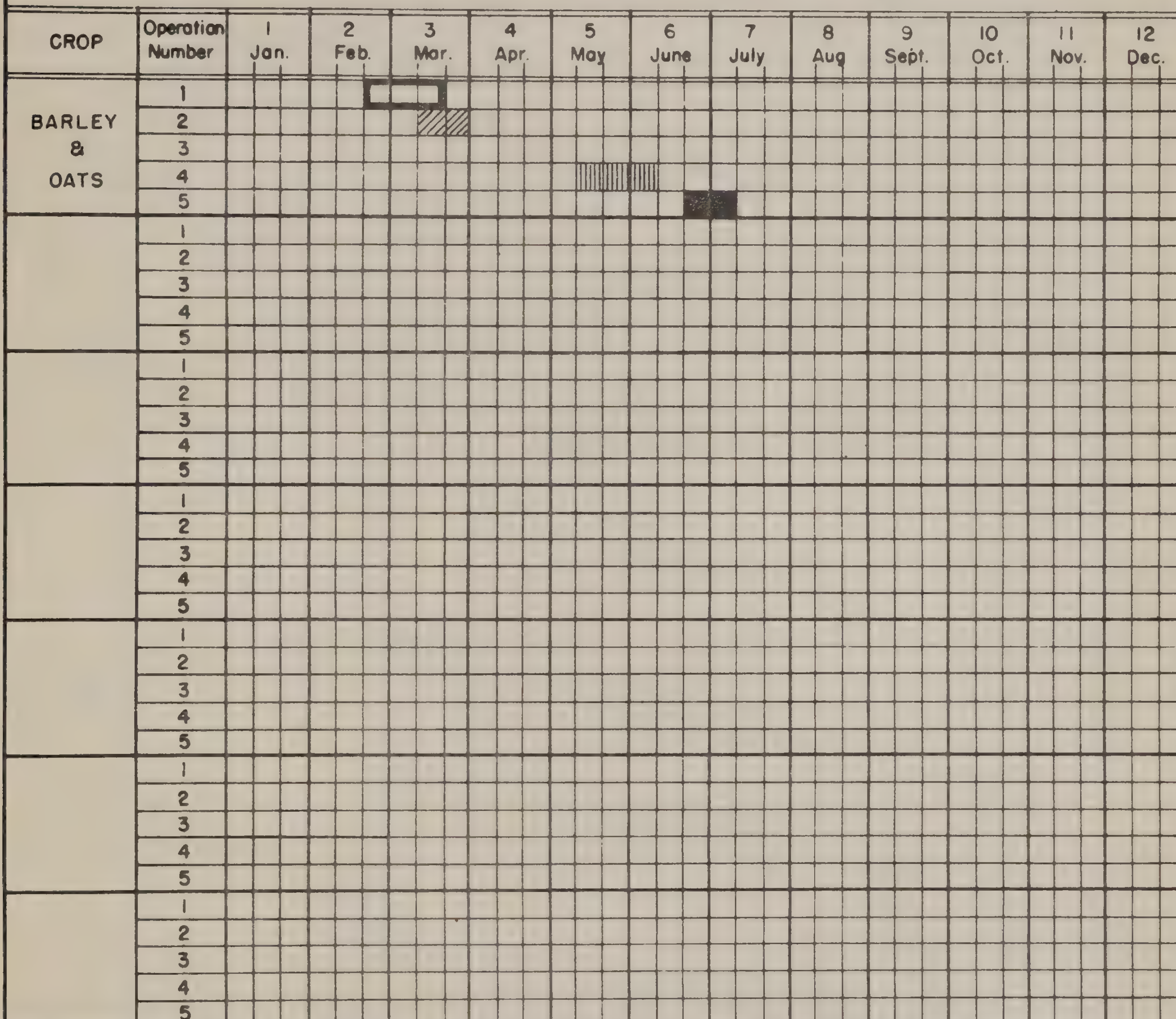
Operation No. 5. Harvesting

CONTINUED

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area GARDEN CITY, KANSAS Growing Season APR. 23 TO OCT. 15 175 days.

Annual Precipitation 17.51 inches. Growing Season Precipitation 13.34 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

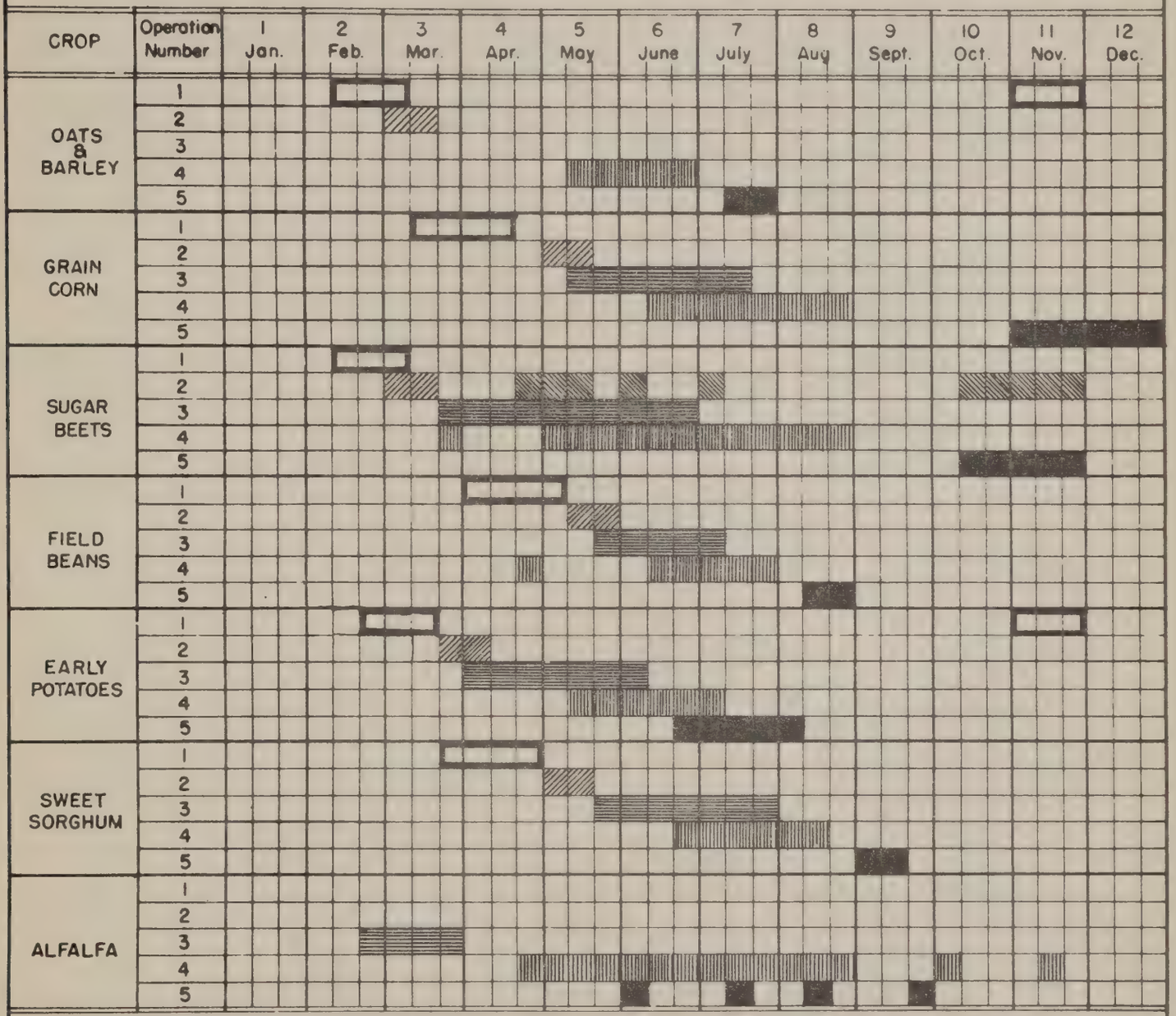
Operation No. 4. Irrigating

Operation No. 5. Harvesting

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area ARKANSAS VALLEY Growing Season APR. 28 TO OCT. 10 – 165 days.

Annual Precipitation 12.75 inches. Growing Season Precipitation 8.5 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

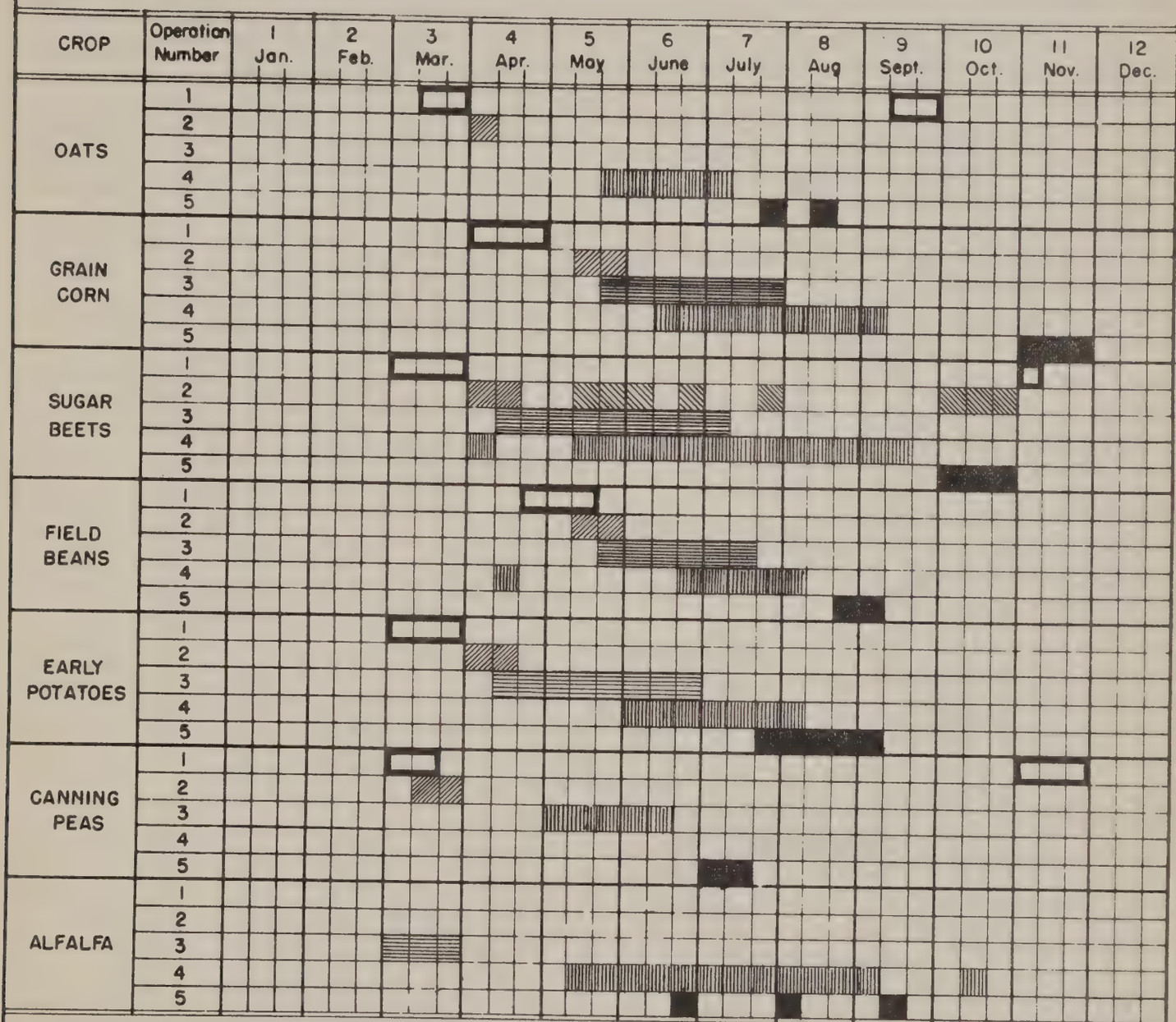
Operation No. 4. Irrigating

Operation No. 5. Harvesting

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area FT. COLLINS-GREELEY, STERLING, COLO. Growing Season MAY 8 TO SEPT. 30 — 145 days.

Annual Precipitation 14.5 inches. Growing Season Precipitation 8.5 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

Operation No. 4. Irrigating

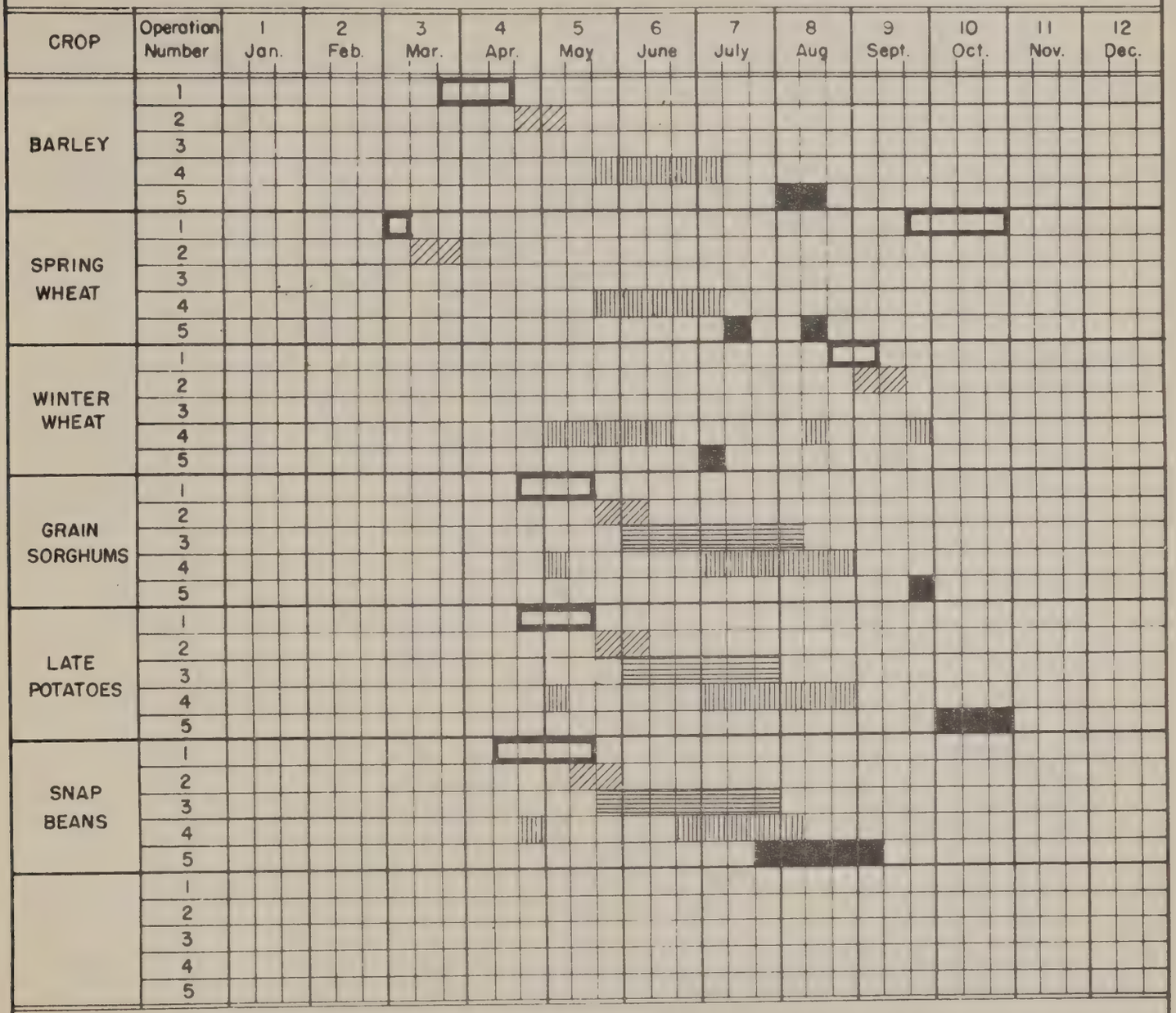
Operation No. 5. Harvesting

CONTINUED

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area FT. COLLINS-GREELEY-STERLING, COLO. Growing Season MAY 8 TO SEPT. 30 145 days.

Annual Precipitation 14.5 inches. Growing Season Precipitation 8.5 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

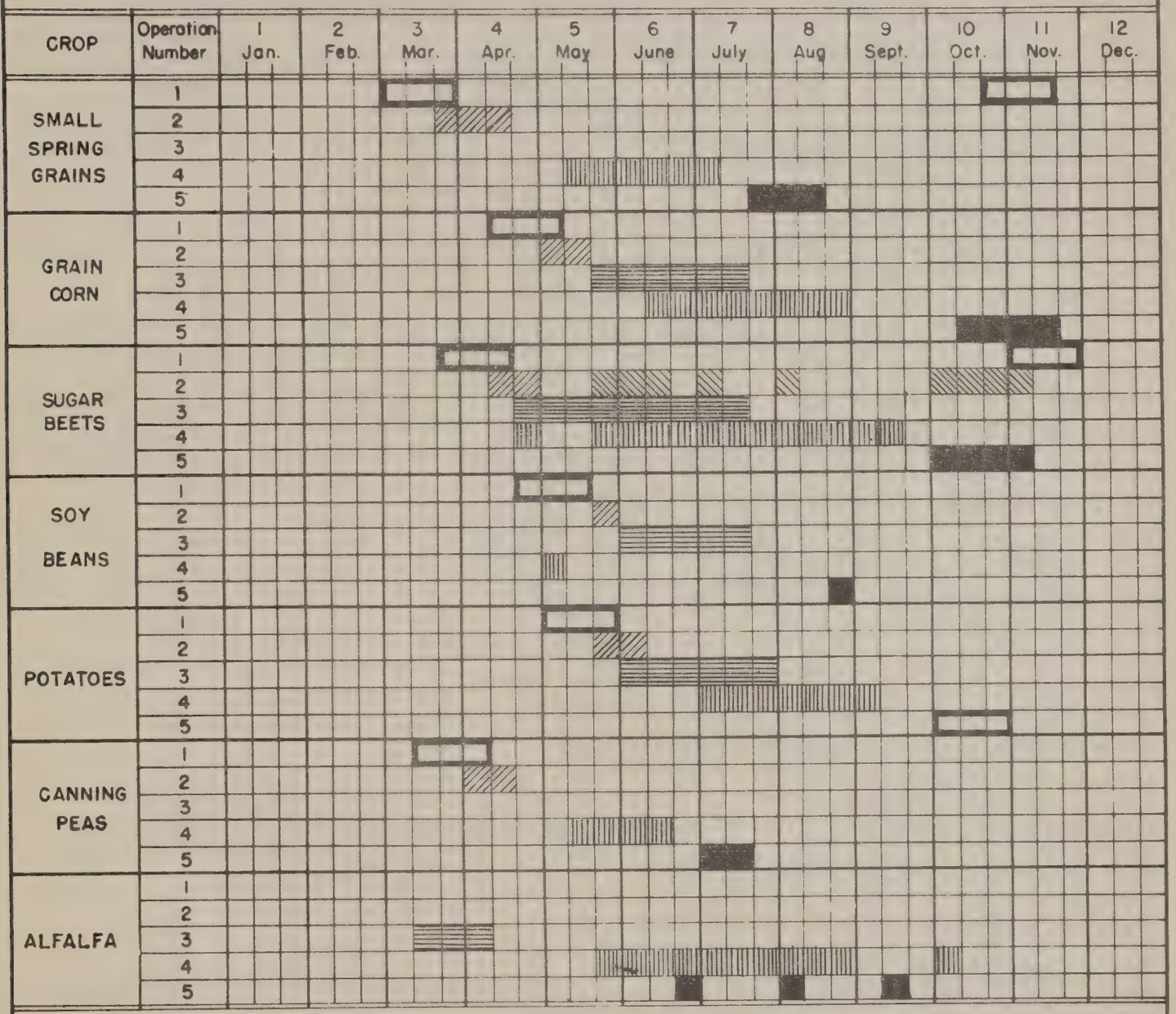
Operation No. 4. Irrigating

Operation No. 5. Harvesting

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area TORRINGTON BASIN, WYOMING Growing Season MAY 13 TO SEPT. 25 135 days.

Annual Precipitation 14.2 inches. Growing Season Precipitation 8.5 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

Operation No. 4. Irrigating

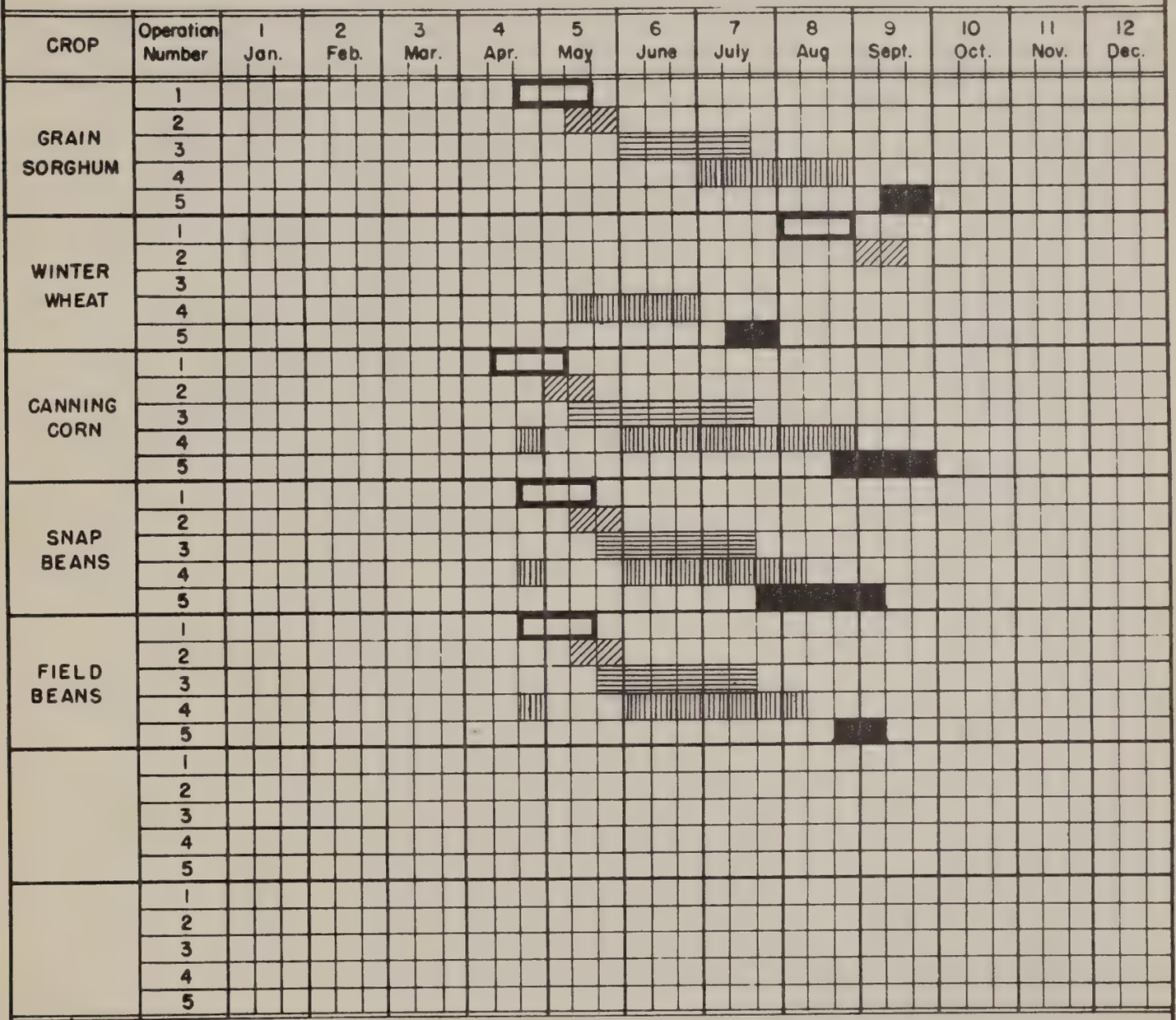
Operation No. 5. Harvesting

CONTINUED

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area TORRINGTON BASIN, WYOMING Growing Season MAY 13 TO SEPT. 25 135 days.

Annual Precipitation 14.2 inches. Growing Season Precipitation 8.5 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

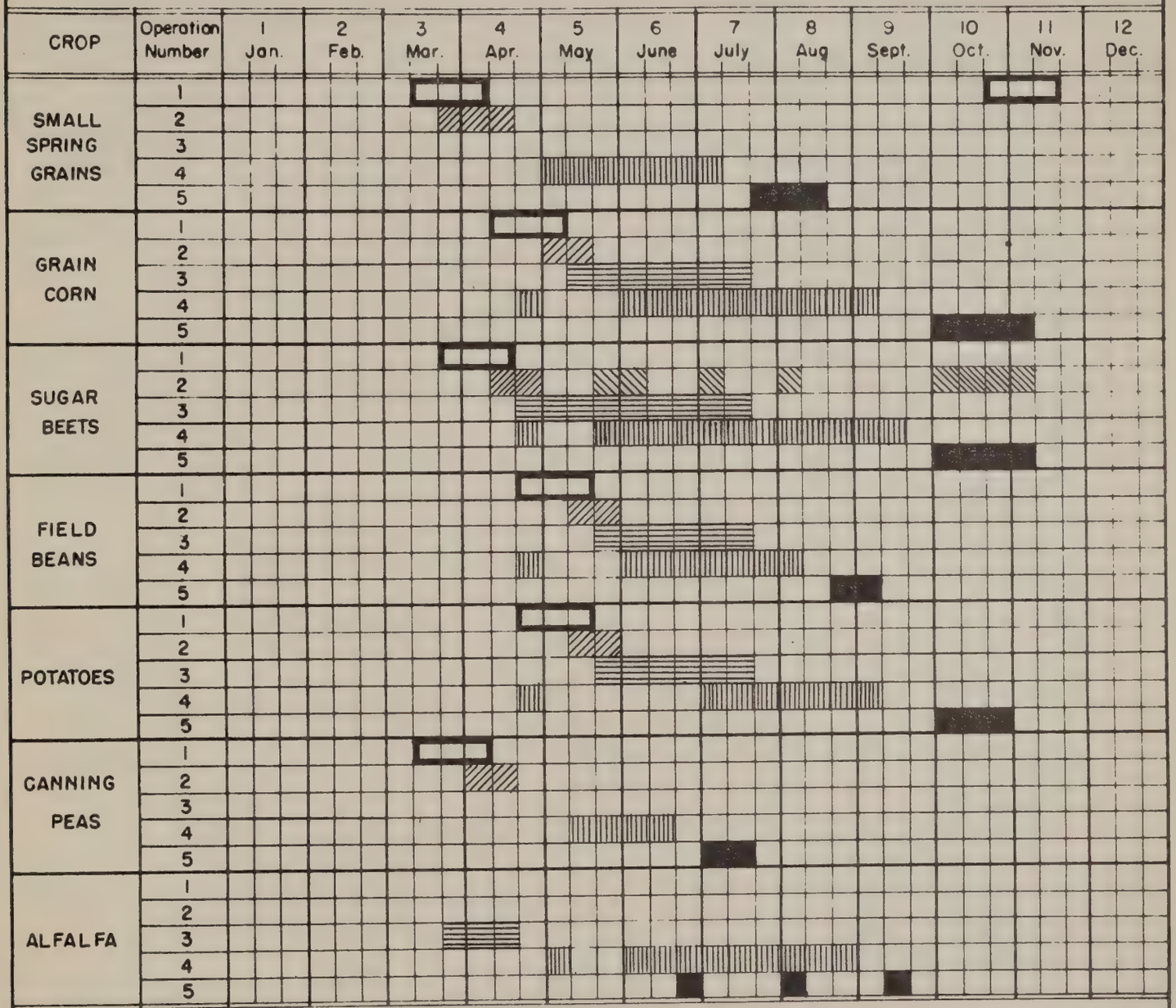
Operation No. 4. Irrigating

Operation No. 5. Harvesting

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area LOVELL-CODY AREA, WYOMING Growing Season MAY 18 TO SEPT. 20 125 days.

Annual Precipitation 6 inches. Growing Season Precipitation 3.5 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

Operation No. 4. Irrigating

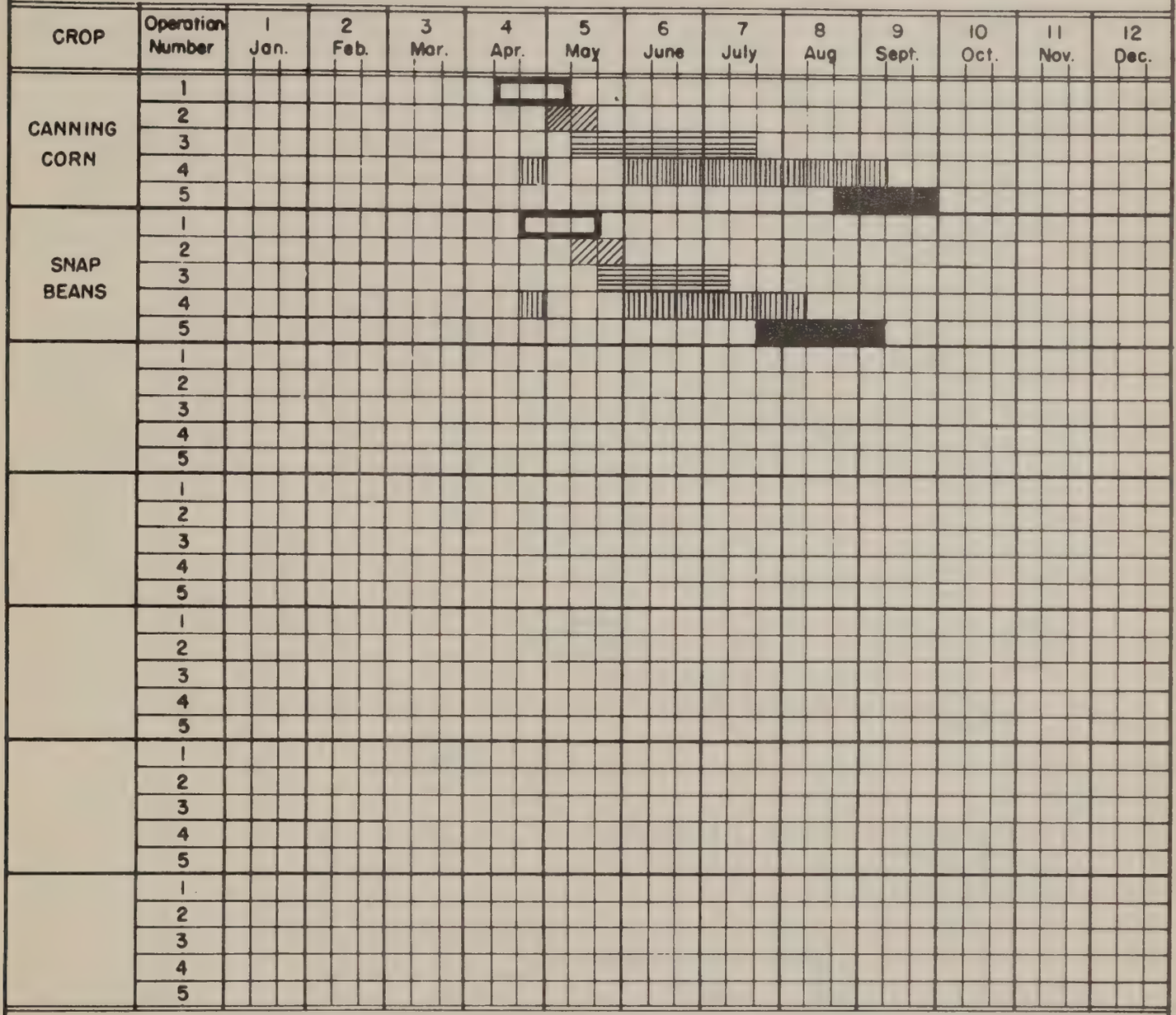
Operation No. 5. Harvesting

CONTINUED

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area LOVELL-CODY AREA, WYOMING Growing Season MAY 18 TO SEPT. 20 125 days.

Annual Precipitation 6 inches. Growing Season Precipitation 3.5 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

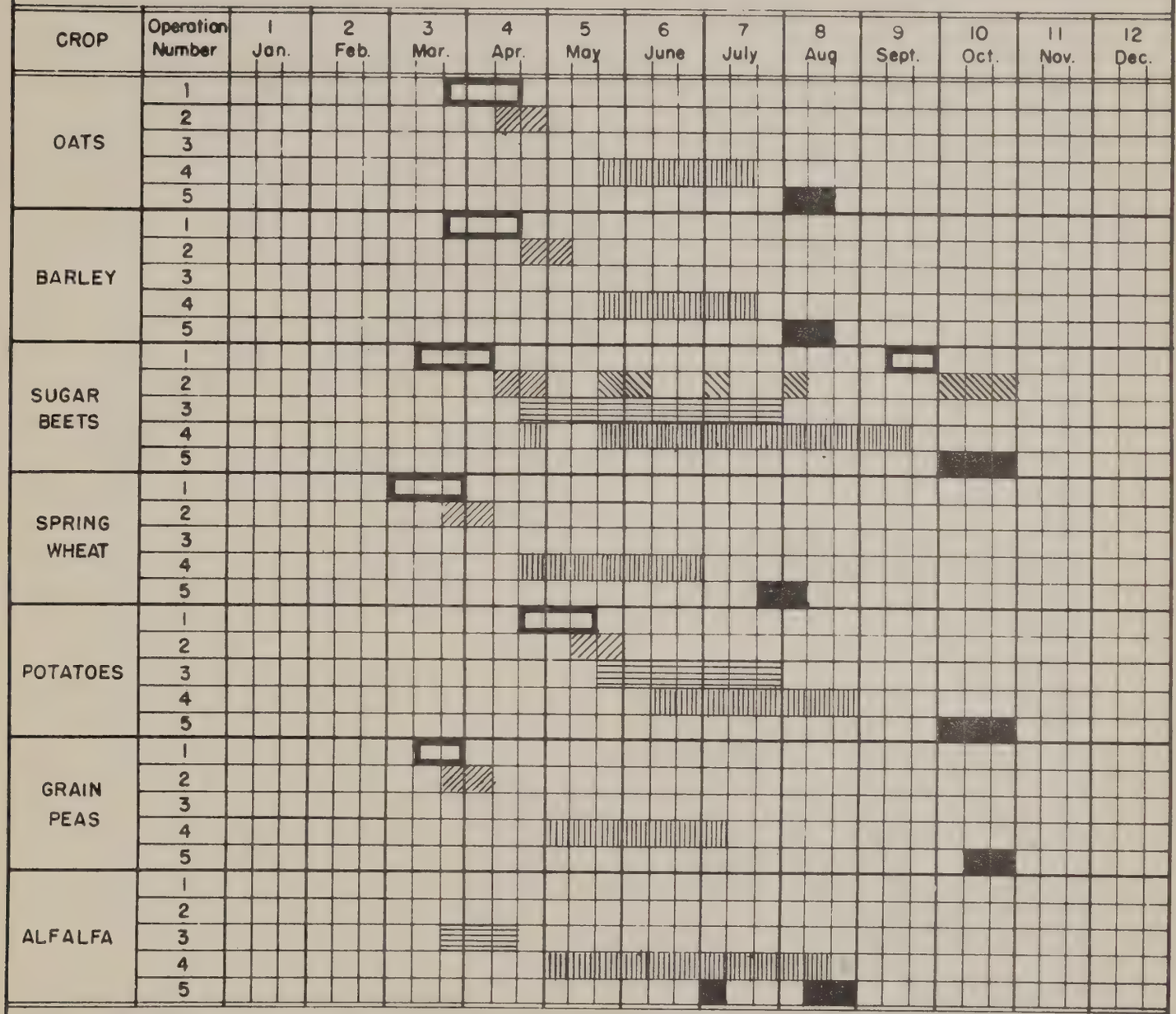
Operation No. 4. Irrigating

Operation No. 5. Harvesting

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area SAN LUIS VALLEY, COLORADO Growing Season MAY 30 TO SEPT. 22 115 days.

Annual Precipitation 8.32 inches. Growing Season Precipitation 5.3 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2.. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

Operation No. 4. Irrigating

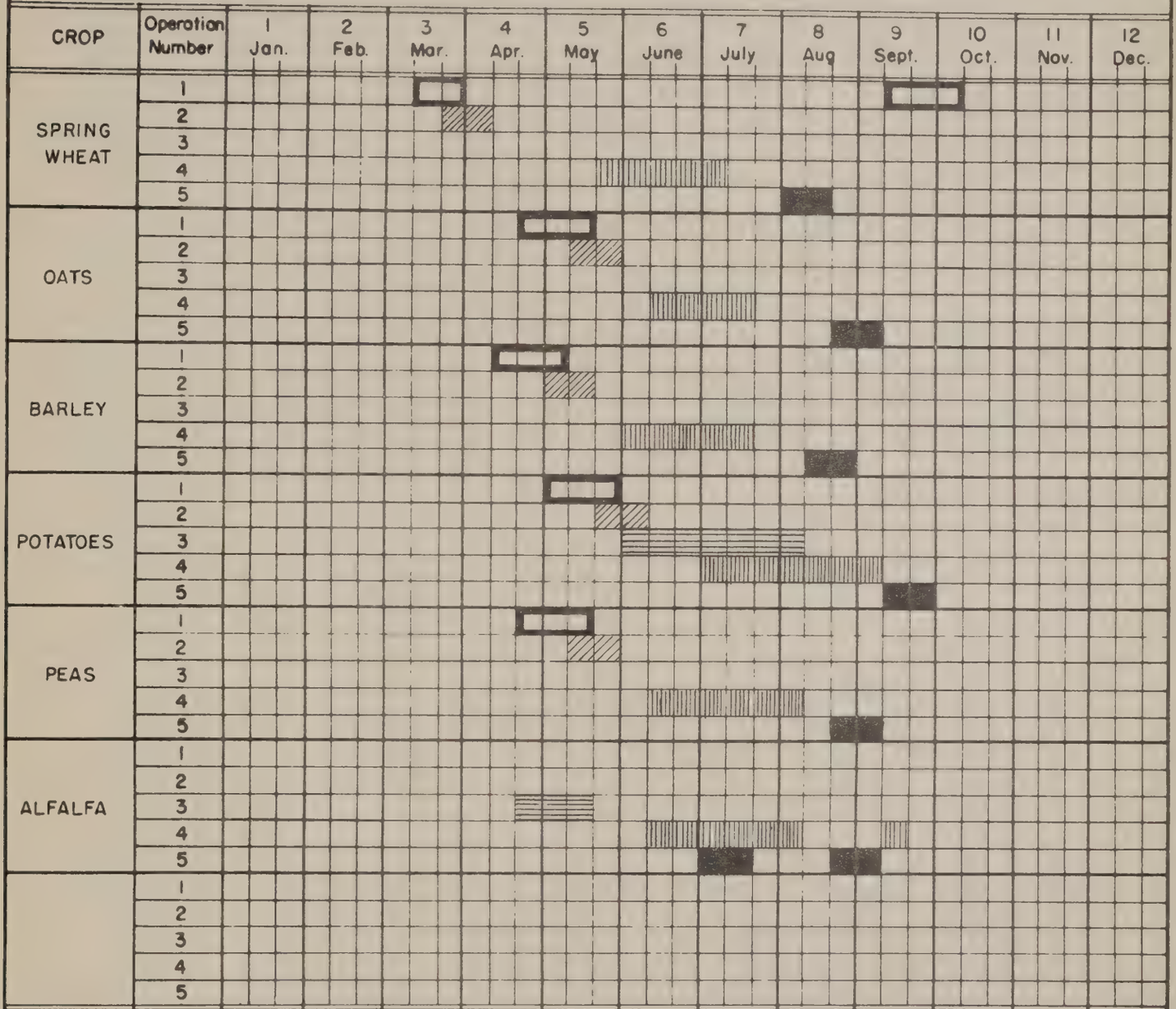
Operation No. 5. Harvesting

Form B

OPTIMUM DATES OF CULTURAL OPERATIONS FOR VARIOUS CROPS

Area BRIDGER VALLEY, WYOMING Growing Season JUNE 9 TO SEPT. 12 95 days.

Annual Precipitation 10.54 inches. Growing Season Precipitation 3.1 inches.



KEY TO OPERATION NUMBERS

Operation No. 1. Preparation of Seed Bed

Operation No. 2. Planting & Hand Labor on Sugar Beets

Operation No. 3. Cultivating

Operation No. 4. Irrigating

Operation No. 5. Harvesting

METHOD OF ANALYZING MAN LABOR REQUIREMENTS

In devising a method for analyzing the labor needs of a given farm, the following steps have been taken:

1. Work units have been prepared which show the number of 10-hour days (P.W.U.) required by the average man to care for each of the various kinds of livestock, including dairying and livestock fattening as specialized enterprises.
2. Similar information has been prepared showing the labor requirements for farm crops produced under irrigation.
3. The work units for farm crops has been broken down by operation, namely, preparation of land, planting, cultivating, irrigating and harvesting.
4. A table was prepared which shows the number of days the operator and his family may put in under several different types of farming.
5. Data were presented on optimum dates of cultural operations for the various crops for several different areas representing different growing seasons.

The next step is to correlate the above information in such a manner that the labor required to operate a given farm can be distributed throughout the year. This can be presented in chart form so that the peak labor periods can be seen at a glance and a type of farming planned which will most fully utilize the labor and other resources of the farm and thereby return optimum net earnings.

Forms to Simplify Analysis of Man Labor Requirements

A series of 6 forms (Form A. B, C, D, E, and F) have been prepared to facilitate the problem of analyzing labor needs and distributing them throughout the year. These forms are to be used in conjunction with the data offered in the preceding pages on work unit requirements for livestock and irrigated crops. Examples of these forms follow within the next several pages. Each has been "filled in" with data for the diversified irrigated farm mentioned on page 4.

Form A - Annual Man Labor Requirements for Crops and Livestock

Form A is used to help prepare a farm plan or to analyze a farm plan now in operation. Columns are provided for entries of the various crop and livestock enterprises constituting the farm plan. Multiplying the number of acres of crops or head of livestock by the appropriate work unit gives the total work units or total days of labor required by the average man to operate the farm unit. Columns are also provided to enter the yield per acre of crops and the annual production of dairy cows since both factors influence the work unit requirement. This form is normally completed first as it forms the main basis of the farm plan. An example of Form A follows this page.

Form A

ANNUAL MAN LABOR REQUIREMENTS FOR CROPS AND LIVESTOCK

Kind of Farm Diversified Irrigated Size of Farm 100 Acres

Crops	No. Acres	Work Unit Per Acre	Total Work Units	Yield Per Acre	Unit
Hay	20	2.6	52.0	3	tons
Wheat					
Oats					
Barley	20	2.1	42.0	45	Bu.
Beans (field)	15	4.0	60.0	25	Bu.
Sugar Beets	15	10.5	157.5	13	tons
Potatoes					
Corn					
Irrigated Pasture	20	.8	16.0	2.0	a. u.
Snap Beans					
Other	10				
Total	100		327.5		

Livestock	No.	Work Unit Per Head	Total Work Units	Yield Per Head	Unit
Dairy Cows	8	15.7	125.6	250	lbs. B.F
Dairy Heifers	2	1.5	3.0		
Dairy Calves Raised	2	1.5	3.0		
Veal Calves	5	0.4	2.0		
Beef Cows					
Other Beef Cattle					
Brood Sow & Pigs	3-36	3.0 - .5	27.0		
Lambs Fattened	305	0.134	40.9.		
Beef Fattened					
Br. Ewes & Rams	102	.5	51.0		
Chickens	100	.2	20.0		
Total			272.5		
Total Work Units on Crops and Livestock			600.0		

Form B - Optimum Dates of Cultural Operations for Various Crops

Form B is used to present the optimum dates for cultural operations for various crops produced in areas with different growing seasons. Cultural operations were broken down into five main phases; namely, preparing land, planting, cultivating, irrigating and harvesting. Other related necessary jobs are included under the appropriate cultural operation. This is normally the second form which is completed in analyzing the farm labor problem. Form B, representing eight different growing seasons, was presented on pages 26 through 33 of this report. These are satisfactory for the areas upon which they are based and can be used with considerable accuracy for other areas of comparable growing seasons and climatic conditions. For greater accuracy in considering local customs and practices, the analyst should prepare for each area in study, similar information to that presented in this form.

Form C - Distribution of Man Labor on Crops by Cultural Operations

Form C is the third form to be completed. It is used primarily as a work sheet in distributing the man labor on crops by cultural operations. The data for the column on "No. of Acres" are obtained from the farm plan or from Form A; the data for the column headed "Work Unit" are obtained from such data presented earlier in this report; the next column is the product of the two preceding. The data for the column "Time Cultural Operations is Performed" and the following column are taken from Form B. The data for the last column are calculated by dividing the "Total Work Units" column by the "Number of 10-day Periods" column. The purpose of the last step is to prepare the data so they can be presented in 10-day periods. An example of this form appears immediately following this page.

DISTRIBUTION OF MAN LABOR ON CROPS BY CULTURAL OPREATIONS

Kind of Farm Diversified Irrigated Size of Farm 100 acres

Crop	Cultural Operations	No. Acres	Work Unit	Total Work Units	Time Cultural Operation is Performed	No. of 10-day Periods	Ave. Per 10-Day Period
	Prepare Land						
	Planting						
Alfalfa	Cultivating	20	.15	3.00	3/1 - 3/3	3	1.00
	Irrigating	20	.65	13.00	5/2 - 9/1 + 10/2	13	1.00
	Harvesting	20	1.80	36.00	6/3 & 8/1 & 9/2	3	12.00
	Prepare Land						
	Planting						
Irr. Pasture	Cultivating	20	.15	3.00	3/1 - 3/3	3	1.00
	Irrigating	20	.65	13.00	5/2 - 9/1 & 10/2	13	1.00
	Harvesting						
	Prepare Land	15	1.00	15.00	4/3 - 5/2	3	5.00
	Planting	15	.25	3.75	5/2 - 5/3	2	1.88
Field Beans	Cultivating	15	1.10	16.50	5/3 - 7/2	6	2.75
	Irrigating	15	.65	9.75	4/2 + 6/3 - 8/1	6	1.62
	Harvesting	15	1.00	15.00	8/3 - 9/1	2	7.50
	Prepare Land	20	.65	13.00	3/3 - 4/2	3	4.33
	Planting	20	.20	4.00	4/3 - 5/1	2	2.00
Barley	Cultivating						
	Irrigating	20	.55	11.00	5/3 - 7/1	5	2.20
	Harvesting	20	.70	14.00	8/1 - 8/2	2	7.00

Crop	Cultural Operations	No. Acres	Work Unit	Total Work Units	Time Cultural Operation is Performed	No. of 10-day Periods	Ave. Per 10-Day Period
	Prepare Land	15	1.20	18.00	3/1 - 3/3 & 11/1	4	4.50
	Planting	15	.25	3.75	4/1 - 4/2	2	1.88
	Cultivating	15	.70	10.50	4/2 - 7/1	9	1.17
Sugar Beets	Irrigating	15	.90	13.50	4/1 & 5/2 - 9/2	14	.96
	Harvesting	15	1.45	21.75	10/1 - 10/3	3	7.25
	Thinning	15	2.45	36.75	5/2 - 6/1	3	12.25
	Hoeing	15	.60	9.00	6/3 & 7/3	2	4.50
	Topping	15	2.95	44.25	10/1 - 10/3	3	14.75
	Prepare Land						
	Planting						
_____	Cultivating						
	Irrigating						
	Harvesting						
	Prepare Land						
	Planting						
_____	Cultivating						
	Irrigating						
	Harvesting						
	Prepare Land						
	Planting						
_____	Cultivating						
	Irrigating						
	Harvesting						

Form D - Distribution of Man Labor on Livestock

The fourth step in analyzing the farm labor requirements is to distribute the man labor for the livestock enterprises throughout the year. The total work units required for each livestock enterprise is placed in the space provided under the "T.W.U." (total work units) line of Form D. The percentage figures appearing opposite each month are then used to distribute the labor throughout the year and the products can be added horizontally and vertically. By cross-footing, the accuracy of these calculations can be proved. Dividing the vertical "total works units" column by 3 permits these data to be placed in the appropriate part of Form E, and subsequently charted by 10-day periods in Form F.

The percentage figures showing the distribution of man labor by months in the livestock enterprises were obtained from numerous livestock cost of production studies. In computing these percentage figures it was assumed that livestock would be run for several months on irrigated farm pastures. If there is an exceptionally long pasture season (over 4 or 5 months) the percentage figures should be changed to reflect the lesser amount of work required while the stock are on pasture. In preparing the labor distribution data for sheep, swine and cattle, it was assumed the sheep would consist of a farm flock, swine would consist of from one to a few sows farrowing each spring with an occasional fall litter and beef cattle and dry stock would consist of a small mixed herd kept on farm pasture in the summer.

A 200-day fattening period was assumed for calves; 166 for yearling steers and 100 days for lambs. The percentage figures presented in this form can readily be revised to fit a given situation. The main value of Form D is its use in recording and systematizing the calculations for distributing man labor on livestock.

An example of Form D follows.

Form D

DISTRIBUTION OF MAN LABOR ON LIVESTOCK

KIND OF FARM Diversified Irrigated SIZE OF FARM 100 Acres

	DAIRY COWS		SHEEP		POULTRY		SWINE		DRY STOCK		LIVESTOCK FATTENING LAMBS		LIVESTOCK FATTENING CALVES & YR.ST.				
MO.	%	WORK UNIT	%	WORK UNIT	%	WORK UNIT	%	WORK UNIT	%	WORK UNIT	%	WORK UNIT	%	%	WORK UNIT	TOTAL WORK UNITS	1/3 * TOTAL
JAN	9	11.3	7	3.6	8	1.6	5	1.4	10	.8	25	10.2	15	18	___	28.9	9.6
FEB	9	11.3	7	3.6	8	1.6	7	1.9	10	.8		___	15	18	___	19.2	6.4
MAR	9	11.3	12	6.1	8	1.6	7	1.9	10	.8		___	15	18	___	21.7	7.2
APR	9	11.3	26	13.3	12	2.4	12	3.2	10	.8		___	10		___	31.0	10.3
MAY	8	10.0	8	4.1	12	2.4	12	3.2	8	.6		___			___	20.3	6.8
JUNE	7	8.8	4	2.0	7	1.4	7	1.9	6	.5		___			___	14.6	4.9
JULY	7	8.8	4	2.0	7	1.4	7	1.9	6	.5		___			___	14.6	4.9
AUG	7	8.8	4	2.0	7	1.4	8	2.2	6	.5		___			___	14.9	4.9
SEPT	8	10.1	4	2.0	7	1.4	9	2.4	6	.5		___			___	16.4	5.5
OCT	9	11.3	10	5.1	8	1.6	9	2.4	8	.6	15	6.1	15	10	___	27.1	9.0
NOV	9	11.3	7	3.6	8	1.6	12	3.3	10	.8	30	12.3	15	18	___	32.9	11.0
DEC	9	11.3	7	3.6	8	1.6	5	1.3	10	.8	30	12.3	15	18	___	30.9	10.3
TOT.%	100		100		100		100		100		100		100	100			
T. W. U.		125.6		51.0		20.0		27.0		8.0		40.9			___	272.5	90.8

EXPLANATION OF TABLE: THIS TABLE SHOWS THE DISTRIBUTION OF MAN LABOR ON THE VARIOUS CLASSES OF LIVESTOCK THROUGHOUT THE YEAR. FOR EXAMPLE, ABOUT 9 PERCENT OF THE TOTAL LABOR ON DAIRY COWS COMES IN JANUARY. IN GENERAL, MORE LABOR IS REQUIRED IN THE WINTER THAN IN THE SUMMER. THE DIFFERENCE IS CAUSED BY THE SMALLER AMOUNT OF LABOR REQUIRED FOR FEEDING AND CLEANING BARNS IN THE SUMMER.

THE LABOR DISTRIBUTION ON SHEEP ASSUMES LAMBING IN LATE MARCH AND APRIL AND RUNNING ON SUMMER PASTURE. IT DOES NOT INCLUDE LABOR FOR SHEARING. SWINE LABOR DISTRIBUTION ASSUMES FARROWING IN THE SPRING WITH A FALL LITTER EVERY OTHER YEAR. DRY STOCK LABOR DISTRIBUTION ASSUMES THE USE OF SUMMER PASTURE.

THE ANALYST SHOULD PREPARE A SIMILAR TABLE TO THIS FOR EACH AREA IN STUDY. THE TABLE SHOULD INCLUDE THE RECOMMENDED PRACTICES IN THE PARTICULAR AREA.

HOW TO USE THIS TABLE: PLACE THE TOTAL ANNUAL LABOR REQUIREMENT FOR EACH CLASS OF LIVESTOCK IN THE PROPER SPACE AT THE FOOT OF THE TABLE. MULTIPLY THIS BY THE PERCENTAGE FIGURES AND PLACE THE PRODUCT IN THE APPROPRIATE SPACE PROVIDED. THE ACCURACY OF THE CALCULATIONS CAN BE CHECKED BY CROSS-FOOTING.

* THE DATA IN THE LAST COLUMN WERE DIVIDED BY 3 TO PERMIT THE DATA TO BE PRESENTED IN FORM E WHICH DIVIDES EACH MONTH INTO THREE 10-DAY PERIODS.

Form E - Recapitulation of Man Labor Requirements for Crops and Livestock by 10-Day Periods

The fifth step in analyzing the farm labor distribution problem should be the recapitulation of the man labor requirements for crop and livestock production. These data can be obtained for crops from Form C and for livestock from Form D. The data should be transferred from the afore-mentioned forms to the appropriate space provided in Form E. As the table is set up, it provides entries for 9 crops and 4 classes of livestock. The table is double-spaced and will provide entries for two sets of figures on each line. When two cultural operations occur simultaneously, as, for example, the irrigation period and the cultivation season; in such instances it is necessary to enter two figures in one space.

If a particular farm plan calls for an analysis of labor on more than 9 crops and 4 classes of livestock, two copies of Form E should be used. Probably not more than the two most important classes of livestock will require complete labor analysis so the space provided should be adequate. The most important use of this form is to show statistically the labor requirements for the various crop and livestock enterprises by 10-day periods. The totals in this table can be checked against the totals in Form A. A study of the totals of this table shows the peak as well as the slack labor periods, and thereby makes possible the planning of enterprises to best utilize the labor resources.

FORM E

4

RECAPITULATION OF MAN LABOR REQUIREMENTS FOR CROP AND LIVESTOCK PRODUCTION BY 10-DAY PERIODS

KIND OF FARM _____ SIZE OF FARM _____

CROP & LIVESTOCK	1 Jan.			2 Feb.			3 Mar.			4 Apr.			5 May			6 June			Sub Total
Alfalfa							1.0	1.0	1.0					1.0	1.0	1.0	1.0	12.0 1.0	20.0
Irrig Pasture							1.0	1.0	1.0					1.0	1.0	1.0	1.0	1.0	8.0
Sugar Beets							4.5	4.5	4.5	1.0 1.9	1.2 1.9	1.2	1.2	1.2 1.0	1.2 1.0	1.2 1.0	1.1 1.0	1.1 1.0	32.7
Hand Labor Sugar Beets														12.2	12.2	12.3		4.5	41.2
Barley									4.3	4.3	4.4	2.0	2.0		2.2	2.2	2.2	2.2	25.8
Field Beans											1.6	5.0	5.0	1.9 5.0	1.9 2.7	2.7	2.7	1.6 2.7	32.8
Total Crops							6.5	6.5	10.8	7.2	9.1	8.2	8.2	23.3	23.2	21.4	9.0	27.1	160.5
Total Livestock	9.6	9.6	9.6	6.4	6.4	6.4	7.2	7.2	7.2	10.3	10.3	10.3	6.8	6.8	6.8	4.9	4.9	4.9	135.6
Grand Total	9.6	9.6	9.6	6.4	6.4	6.4	13.7	13.7	18.0	17.5	19.4	18.5	15.0	30.1	30.0	26.3	13.9	32.0	296.1

CROP & LIVESTOCK	7 July			8 Aug.			9 Sept.			10 Oct.			11 Nov.			12 Dec.			Grand Total
Alfalfa	1.0	1.0	1.0	12.0 1.0	1.0	1.0	1.0	12.0			1.0								52.0
Irrig. Pasture	1.0	1.0	1.0	1.0	1.0	1.0	1.0				1.0								16.0
Sugar Beets	1.1 1.0	1.0	1.0	.9	.9	.9	.9	.9		7.2	7.2	7.3	4.5						67.5
Hand Labor Sugar Beets			4.5							14.7	14.8	14.8							90.0
Barley	2.2.			7.0	7.0														42.0
Field Beans	1.6 2.8	1.6 2.8	1.7	1.7		7.5	7.5												60.0
Total Crops	10.7	7.4	9.2	23.6	9.9	10.4	10.4	12.9		21.9	24.0	22.1	4.5						327.5
Total Livestock	4.9	4.9	4.9	4.9	4.9	4.9	5.5	5.5	5.5	9.0	9.0	9.0	11.0	11.0	11.0	10.3	10.3	10.4	272.5
GRAND TOTAL	15.6	12.3	14.1	28.5	14.8	15.3	15.9	18.4	5.5	30.9	33.0	31.1	15.5	11.0	11.0	10.3	10.3	10.4	600.0

Form F - Seasonal Man Labor Distribution Chart

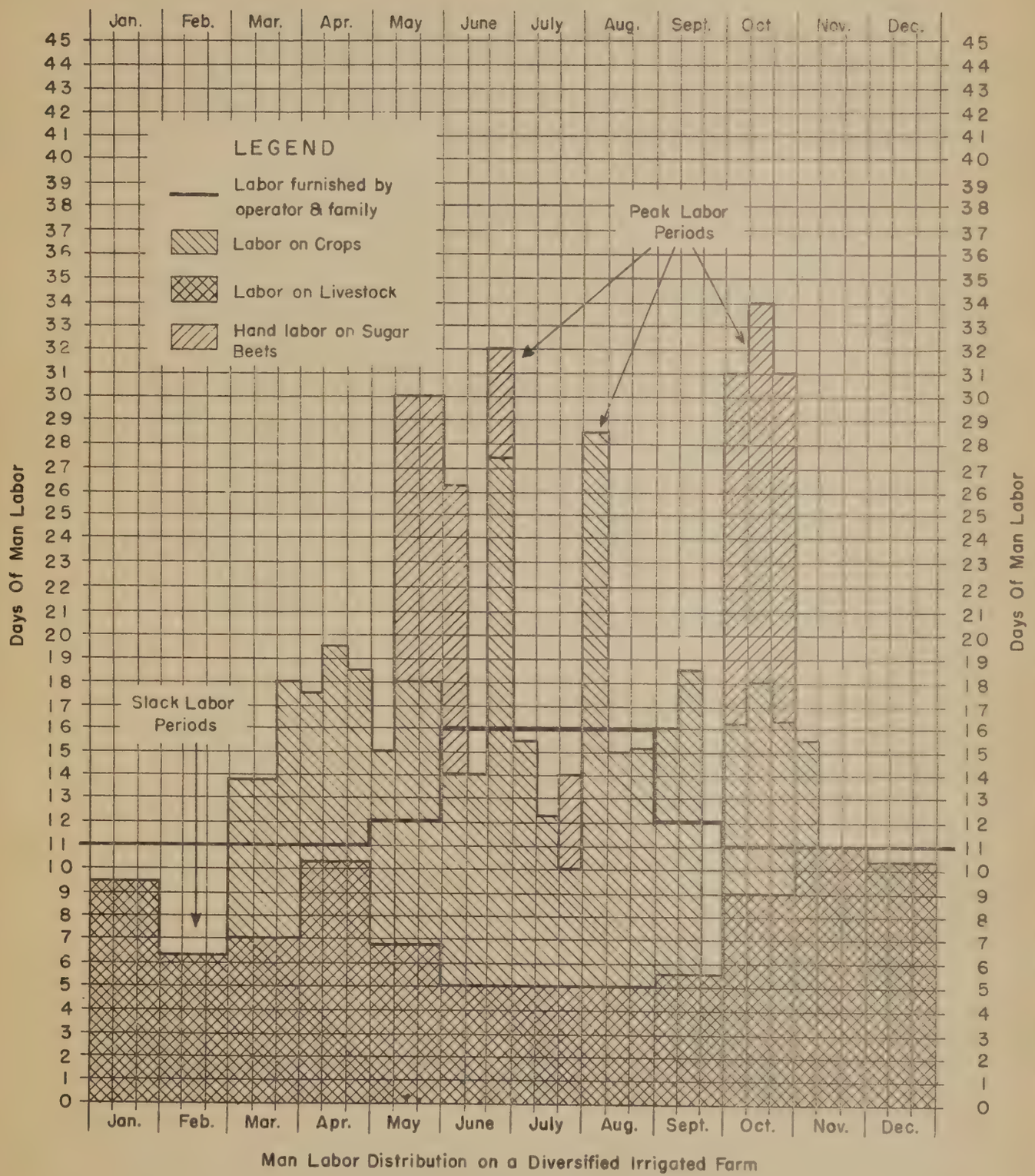
Form F is used to chart the distribution of man labor on crops and livestock throughout the year by 10-day periods. The scale indicates that each square represents 1 day or 10 hours. The data in Table E can be transferred directly to Form F either by using different colors or symbols for each crop or livestock enterprise or by transferring only the crop and livestock totals, thereby requiring only 2 symbols or colors. If desirable, the hand labor on such crops as sugar beets or truck crops can be shown separately. It is desirable to place the livestock labor at the bottom of Form F as it is more apt to be carried on over the full 12 months, whereas crop labor may not permit distribution throughout the year.

After the data are transferred to Form F some study of the chart is desirable. It should be remembered that the dates given for cultural operations in Form B are optimum dates and in some cases should be changed under certain conditions. For example, peak labor loads often are caused by labor competing crops. Haying and small grain harvest often compete for labor. It may be desirable from a labor efficiency viewpoint to cut and shock the grain when it is ripe and wait several weeks or a month or two before threshing. Parts of the corn harvest can be deferred until a later date as can certain other crop cultural operations. The third cutting of alfalfa hay may be spread over a greater length of time than is used in this example. If the farm does not grow sugar beets or other late maturing crops, the fall plowing will likely be done earlier than is shown in some of the charts.

An example of Form F appears on the following page. The data presented are the same as in the chart found on page 5 of this report.

Form F

SEASONAL MAN LABOR DISTRIBUTION CHART



Man Labor Distribution on a Diversified Irrigated Farm

(Each Square Represents One Ten-Hour Day)

All of these forms are merely means to an end. The end or purpose of the labor analysis of a proposed farm unit is to make sure that the type of farming and the quantity and combination of enterprises proposed are so planned as to secure optimum distribution of labor for the operator and his family. As stated previously, if an operator has above average managerial ability, he can probably hire labor at a profit and his goal therefore should be the hiring of all the labor needed to operate the farm in excess of that furnished by the family and by himself. It may well be pointed out again that other factors besides labor efficiency influence profits in agriculture and that to over-emphasize the planning for efficient use of labor to the exclusion of other considerations may be as dangerous as to under-emphasize the labor problem.

After Form F is completed a line or curve representing the amount of labor to be performed by the operator (or the operator and family) can be sketched in. The data for the curve can be transferred from the table presented on page 23 of this report. All of the days of labor falling above this curve will need to be hired by the average operator unless there are many spaces which are not occupied below the curve. In such cases it may be possible for the operator to exchange labor during the time his farm does not keep him fully employed.

EXAMPLE OF METHOD FOR ANALYZING FARM LABOR NEEDS

Diversified Irrigated Farm

For the purpose of clarity it is desirable to provide an example of this proposed method for analyzing farm labor needs. A diversified irrigated farm with medium crop yields, operating in a 145-day growing season, is used for an example.

The crop and livestock organization plan is shown as follows:

Crop	No. Acres	Per Acre Yield
Alfalfa Hay	20	3 Tons
Sugar Beets	15	13 Tons
Barley	20	45 Bu.
Field Beans	15	25 Bu.
Irrigated Pasture	20	2.0 A.U.
Other (farmstead, waste, etc.)	10	-
Total	100	

Livestock	No.	Annual Production
Dairy Cows	8	250 Lbs. B. F.
Dairy Heifers	2	-
Dairy Calves Raised	2	-
Ewes and Rams	102	100 Lambs
Sows and Pigs	3 & 36	36 Pigs
Chickens	100	10 Doz. Eggs
Lambs Fattened	305	-
Veal Calves	5	Veal

Example of Use of Forms for Seasonal Labor Distribution

The various mimeographed forms discussed in previous pages will hereafter, for the purpose of brevity, be referred to as Form A, B, etc. All six of these forms have appeared in the pages immediately preceding this discussion and all have been "filled in" with statistical data concerning the diversified irrigated farm. The reader might turn to the pages as reference is indicated. The method will be simpler to understand if the reader will check all calculations as they are presented.

The first step in distribution of man labor throughout the year is to complete Form A (page 36). The column "No. Acres" is taken from the farm plan shown on page 4 or 46. The "work units" are taken from pages 13 and 14. It is assumed that the hay is harvested with the use of wagons and hauled to the barn since it is to be used largely for dairy production and lamb fattening. A yield of 3 tons per acre requires 2.6 days of labor per year (page 13). The grain yields fall in the medium class and in this example it is assumed they are threshed from the shock, thus the "work unit"of 2.1 per acre (page 13). Similarly the other crop work units are transferred to Form A and multiplied by the number of acres to obtain the "Total Work Units." The sum of this column is 327.5 which means that many days are required of the average man to produce and harvest the 90 acres of crops.

The number of head of livestock are next transferred from page 44 to Form A. The work unit per cow for 8 dairy cows producing 250 pounds of butterfat ($3\frac{1}{2}$ percent butterfat test) is found on page 10. An estimate shows this to be about 15.7 days or about the same per head as an 8-cow herd producing 254 pounds of butterfat. The 8 cows times 15.7 days per cow shows 125.6 days of labor are provided (or required) by the dairy cows. Most of the other labor units were taken from page 9. The work unit for the 305 lambs fattened is approximately .134 per head (page 11). Summation of total work units shows that 272.5 days are required for livestock and 327.5 for crops which makes a total of 600.0 for the farm unit.

The table on page 23 indicates that on a farm unit embodying crop production and one-half dairy and one-half fattening unit (which would approximately represent this example) the average operator is able to contribute 300 days and the family 150 or a total of 450 days. The 102 ewes and rams carried

on the farm all year and 305 lambs fattened, represent the equivalent of about one-half of a fattening unit.

The problem is to distribute the 600 days of work throughout the year on a chart and then sketch in a curve representing that part of the total labor requirement which may be accomplished by the operator and family, and thereby determine the amount and at what dates labor must be hired.

The second step is to prepare a chart which shows the recommended dates of planting, harvesting, etc. of the crops in this proposed farm plan. In the preparation of this cultural-operations chart or crop-work calendar, consideration should be given to practices and customs which local farmers have found to be most successful. The farm plan used in this example was for an area having a 145-day growing season. The chart on pages 29 and 29A will be used to properly apply to this farm plan. This chart indicates for example that sugar beets should be planted during the first 20 days of April. The land could be plowed in early November if possible, and harrowed, leveled, etc. just prior to planting. The first irrigation should be given as soon as the beets are planted. About 6 to 8 irrigations are necessary to produce a crop of sugar beets in the area to which these data apply. Form B (page 29) shows the irrigation of sugar beets is carried on nearly up to harvest time. This method of showing irrigation dates is satisfactory when analyzing the labor requirements for irrigation for the entire farm, but if total labor requirements were being analyzed for each crop separately, the irrigations should be shown as separate operations. For example, on sugar beets the first irrigation would come during the first 10-day period in April, or as soon as the beets are planted; the second during the middle period of May; the remaining irrigation approximately during every other 10-day period until harvest.

Since climatic conditions, soils and customs differ in each area, it is desirable for the labor analyst to consider local practices and conditions in preparing Form B. For example, in many areas it is not necessary to irrigate sugar beets up, and in other areas only 3 or 4 irrigations are required. The preparation of this form makes possible the third step in analyzing the labor needs of this diversified irrigated farm.

The third step consists of completing Form C. It may be helpful to follow through part of the calculations on the 20 acres of alfalfa. The requirement in work units for cultivating is found on page 16 to be .15 per acre or a total of 3.0 work units are required to cultivate the 20 acres of alfalfa. The cultural operations chart on pages 29 and 29A shows this should be done during the three 10-day periods of March. These dates are recorded in the proper place in Form C by the figures 3/1 to 3/3. It will be noted that this means from and including the first period in March to and including the last period of March. There are three 10-day periods involved or an average of 1.00 work unit per period. Similarly the other operations of irrigating and haying can be calculated. Summing the total work units for alfalfa in Form C shows: 3.0 for cultivating; 13.0 for irrigating, and 36.0 for harvesting, or a total of 52.0. This total can be checked by referring to Form A. It will be noted that the work on alfalfa does not include the work of seedbed preparation, planting, etc. as this is included as part of the work on small grains. The same approach, including checking of totals, should be used in the calculations for the other crops. For irrigated pasture, the time of cultivating and irrigating is the same as with alfalfa.

The fourth step is to complete Form D which has been prepared to expedite the distribution of man labor on livestock. Form A shows that 125.6 days are required to care for the 8 dairy cows. This total is entered in place provided

under T.W.U. (total work units) on Form D. Multiplying this by the percentage figures permits its distribution throughout the year. Similarly the other livestock enterprises are worked out. Adding the work units in this form vertically and horizontally gives the total work units. Adding these totals both vertically and horizontally permits checking the accuracy of the calculations. Dividing the figures in the vertical total work unit column by 3 permits these data to be charted by 10-day periods.

If the analyst finds local conditions differ greatly from those upon which the labor distribution for livestock was based, the percentage figures should be adjusted to consider these variations.

The fifth step is to transfer the data from Form C and D to Form E which is used to summarize or recapitulate the days of man labor required on crops and livestock by 10-day periods. Form C shows that cultivation of alfalfa comes during the three 10-day periods of March with 1.00 day or work unit per period. These figures are transferred to the proper space in Form E. Form C shows irrigation of alfalfa begins in the 2nd period of May and continues through the 1st period of September for 12 consecutive periods. One later irrigation is given during 2nd period of October. These 13 periods divided into the 13 days (or work units) to be spent irrigating equals 1.00 day per period which figure was entered in the proper place on Form E. Harvesting (haying) requires three periods of 12.0 days per period. These occur simultaneously with irrigation so two entries must be made in one space as shown in Form C for third period in June, the first period in August and the second period in September. Summing all entries in Form E for alfalfa shows a total of 52.0 days which checks with the totals in Form A. The analyst may not wish to show hay harvest and irrigation being carried on simultaneously (one field

or portion of field being irrigated while the other field or portion of field is being cut) in which case the necessary adjustments can be made by showing exactly when the irrigation should occur.

The data on the remaining crops are entered the same as alfalfa, and a summation is made of the total work units on crops. These can be checked against the total in Form A.

The data for livestock in Form D can be entered either by separate classes of livestock or merely as totals. If more than 4 classes are entered (plus the remaining classes which are all added together), more than one page of Form E will be required. Form D shows that 28.9 work units are required for livestock in January or 9.6 days for each 10-day period. Thus, 9.6 is entered in Form D under "Total Livestock" for each of the 10-day periods in January. Similarly the data for the other months are transferred from Form D to Form E. The total livestock and crop labor after being transferred to Form E can be totaled and checked against the totals shown in Form A.

Form E shows statistically the labor distribution throughout the year by 10-day periods. The peak loads and slack periods can be seen and at this phase of labor analysis any desirable adjustments can be made. For example, a perusal of Form E shows that omitting hand labor on sugar beets, the peak labor periods occur during the last period of June, and the first period of August. There are also peak periods requiring hand labor during sugar beet blocking and thinning and during the pulling and topping season. This form and Form B indicate that the farm labor during these peak periods consists of haying and such general farm work as irrigation and cultivation and grain harvest. The general farm work must go on, so the most likely way to reduce these peak labor periods is to lengthen the haying period by exchanging labor

with a neighbor. If such a labor exchange were effected, it would be possible to reduce the peak loads in each case by several days by doing this work in the period immediately preceding or following. This assumes the neighbor's hay would be put up in one 10-day period and the farmer's hay immediately preceding or following. It will be noted that no man labor is spent on crops during the last 10-day period in September but 12.9 days are spent on crops during the middle period of this month. The 12.0 days are for putting up the third crop of hay which probably could be spread over the middle period and part of the last period of September. This would reduce the amount of hired labor needed for third crop and would provide labor for what would otherwise be a slack period.

The sixth step in the labor analysis is to transfer the data from Form E to Form F which shows graphically the man-labor requirements for the diversified irrigated farm distributed throughout the year by 10-day periods. In this example the total labor for all classes of livestock is shown at the bottom and the total crop labor is at the top; the hand labor for sugar beets is shown separately. If desirable, the labor for each crop or class of livestock can be shown separately by different symbols or colors.

CONCLUSIONS AS TO LABOR NEEDS

The final step is to sketch in the curve which represents the amount of labor which the operator (and his family, if desired) can contribute toward the total labor requirements. In the accompanying example the labor contribution of both the operator and family is represented by the curve. The data for sketching in the curve was taken from page 23. A study of this chart shows there are several peak labor periods which are caused by spring planting work and haying which must be done in a comparatively short period of time. Form A

indicates 600 days of man labor are required to operate the farm unit and that the operator and family theoretically could contribute 450 days (see table on page 23) if work were always available to be done. The labor distribution chart (Form F) indicates that the livestock enterprise furnishes enough labor to almost fully utilize all of the family and operators' labor in the winter months (with the exception of about 18 days in January and February) and there are a few days (about 10) of unemployment during the summer. There would likely be no days of under-employment in September if the third cutting of alfalfa were spread over the last 20 days in the month. Counting all squares above the labor input curve indicates the number of days which probably should be hired by the average operator for this farm unit. In this example it will consist of a man for about 2-1/3 months beginning in late March and continuing through May; about 24 days during the first two hay cuttings; and about 4 days in September to help with bean harvest. This assumes the last cutting of hay is extended into the last 10-day period of September. Also, the hand labor for the sugar beets (except the second hoeing) will need to be hired and about 22 days of farm labor will need to be hired during and immediately following sugar beet harvest.

This discussion is not concerned with attempting to smooth out the peak labor periods by substituting crops which may require labor at times which compete less seriously for labor. It is assumed that in preparing a farm plan the analyst will consider such factors as crop rotations and soil adaptation, price relationship between crops, need for cash and feed crops, labor competition, etc. and will then choose the crops and acreages of each which offer the greatest net return after considering all factors.

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